SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y. as Second Class matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXVI.—No. 16. ESTABLISHED 1845. NEW YORK, APRIL 17, 1897. $3.00 A YEAR. WEEKLY.

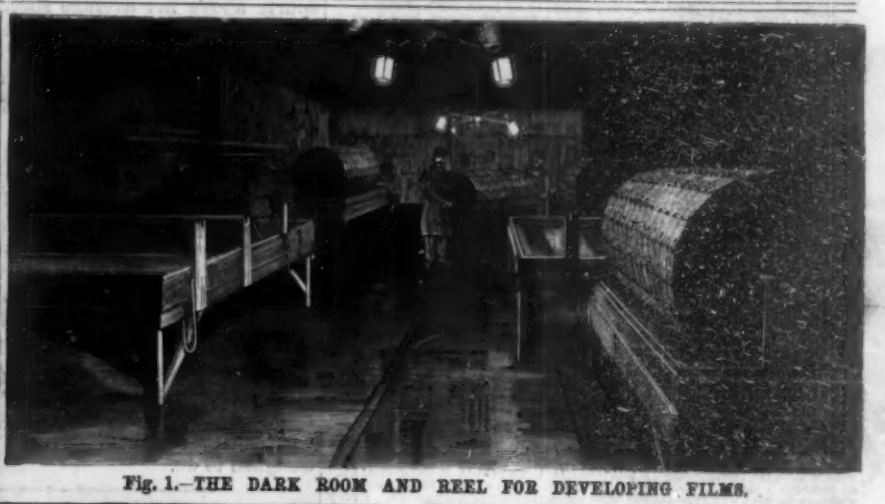

Fig. 1.—THE DARK ROOM AND REEL FOR DEVELOPING FILMS.

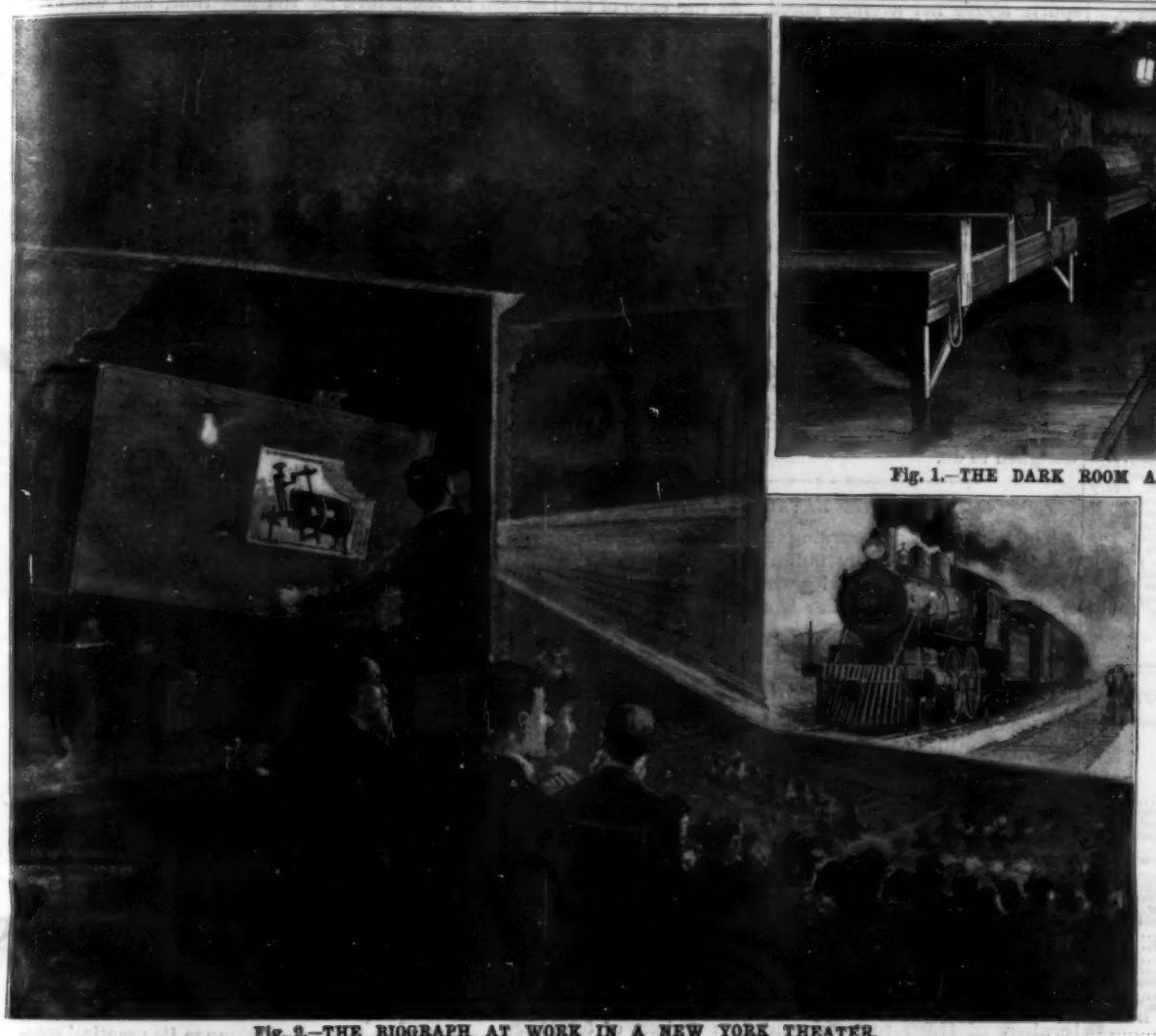

Fig. 2.—THE BIOGRAPH AT WORK IN A NEW YORK THEATER.

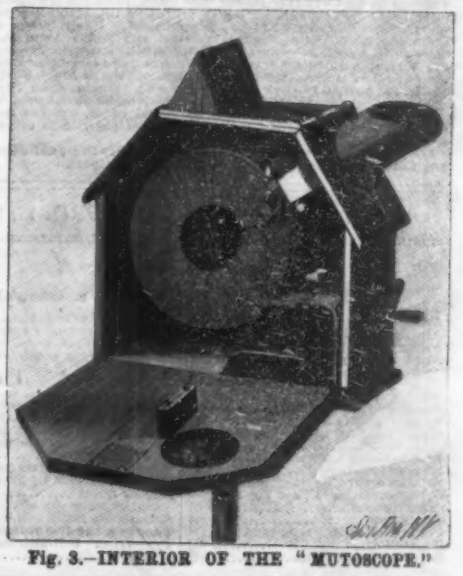

Fig. 3.—INTERIOR OF THE "MUTOSCOPE."

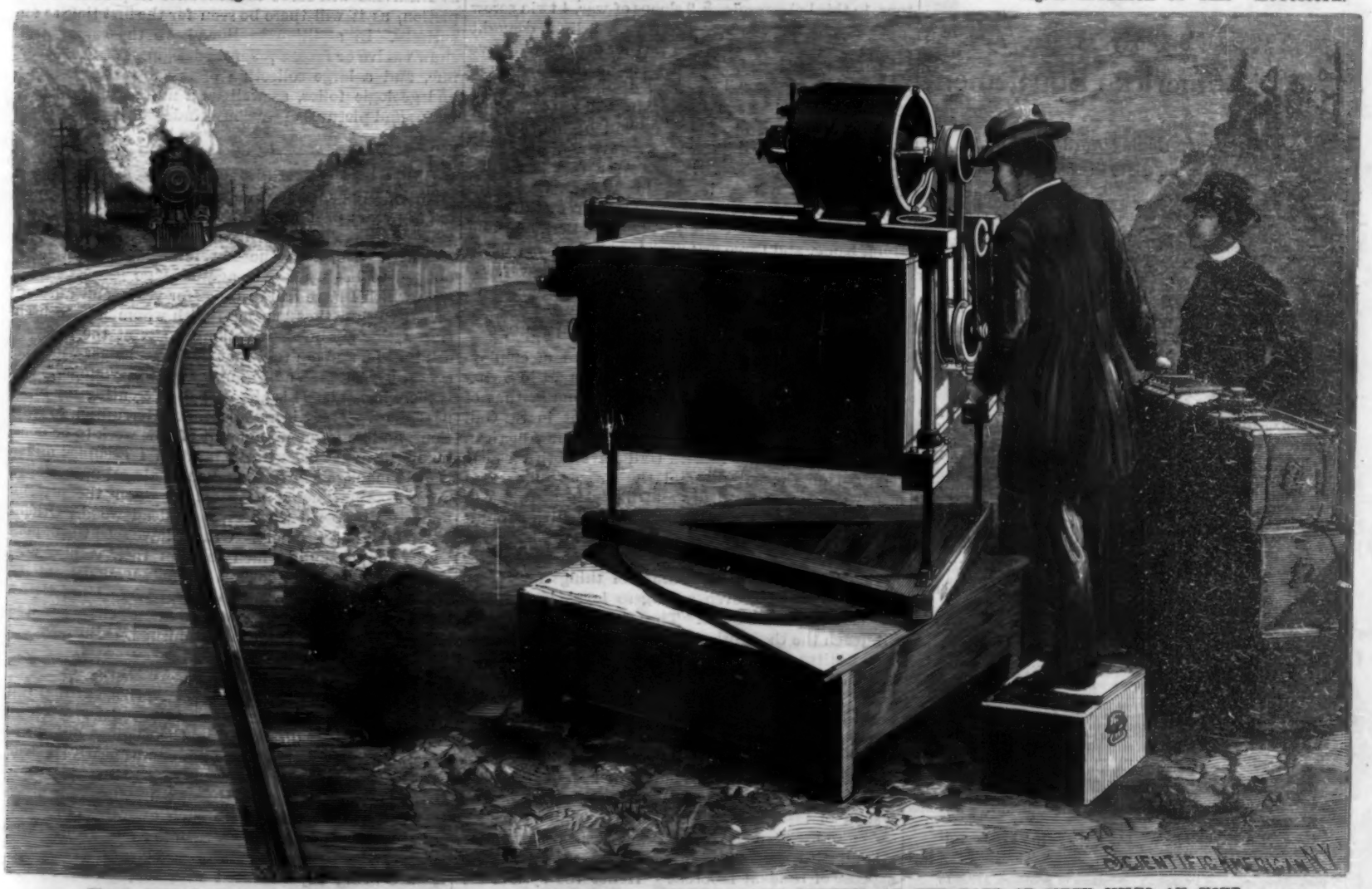

Fig. 4.—THE "MUTOGRAPH" PHOTOGRAPHING THE PENNSYLVANIA LIMITED WHEN RUNNING AT THE RATE OF SIXTY MILES AN HOUR.

PHOTOGRAPHY AS AN ADJUNCT TO THEATRICAL REPRESENTATION.—[See page 248.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3.00
One copy, six months, for the U. S., Canada or Mexico..... 1.50
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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

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(Established 1876)

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(Established 1878)

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NEW YORK, SATURDAY, APRIL 17, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

No. 1111.

For the Week Ending April 17, 1897.

Price 10 cents. For sale by all newsdealers.

TRIAL TRIP OF THE BATTLESHIP IOWA.

First-class sea-going battleship Iowa completed her trial trip over the official course on April 7, when she maintained an average speed of 17 knots during a continuous run over a 66 mile course. The run was completed after about eight hours of continuous steaming, at the end of which her boilers and machinery were in first-class working condition. The average boiler pressure was 152 pounds per square inch with one inch of air pressure in the stoke hole. The engines averaged about 112 revolutions per minute for the whole run. It is noticeable that the speed was remarkably uniform, and that there was no evidence of the ship making any spurts above her average speed. At the close of the run, the Iowa was tested as to her steering capabilities, and the helm being put hard over, she swung for a complete half circle, first to port and then to starboard. She was very quick in answering her helm and proved that she could turn a circle of something under 400 yards. It was noticeable that when the ship was being driven at full speed there was practically no vibration, what little there was being noticeable at the bow and stern. The contract speed for the Iowa was 15 knots per hour, and the builders were to receive a bonus of $25,000 for every quarter of a knot in excess; a stipulation which will secure to William Cramp & Son, of Philadelphia, the sum of $200,000.

The Iowa was designed for a speed of 15 knots under an indicated horse power of 11,000. As the power necessary to drive a ship varies as the cube of the speed, it is evident that on this occasion she must have indicated some thousands of horse power more than she was designed to do.

ENGLAND'S NAVAL POLICY.

The latest advices regarding the proposed increase to the English navy plainly indicate that there is to be no cessation in the activity which has characterized naval shipbuilding in that country for the last few years. The amount of money that has been appropriated for increasing and carrying on the naval establishment is something over $115,000,000. During the next few months the government will commence the construction of four battleships of nearly 15,000 tons, three third-class cruisers, two sloops of war, four twin screw gunboats and two torpedo boat destroyers. A new yacht will also be built to take the place of the Victoria and Albert, a paddle steamer which has been used by royalty for a great many years. It is intended that the new yacht shall be one of the most sumptuous of its kind afloat.

The current programme is one of the largest ever laid down by Great Britain, as may be judged from the fact that during the next twelve months she will have built or will be constructing 14 first-class battleships of between 13,000 and 15,000 tons displacement, 8 first-class cruisers of 11,000 tons, 9 second-class cruisers of 5,800 tons, 10 third-class cruisers, 2 sloops of war, 4 twin screw gunboats, 52 torpedo boat destroyers, 8 light draught steamers for river service, besides the royal yacht above mentioned. The list above given represents in the aggregate 108 vessels, whose total displacement will be 380,000 tons and the total horse power 800,000. The total number of men in the navy will be increased to over 100,000. Under the head of improvement of foreign naval stations, provision is made for very extensive dredging, with a view to securing safe anchorage for ships of the deepest draught at all seasons of the year. Large docks are to be built at Jamaica, Bermuda and Hong-Kong, and three dry docks are to be constructed at Gibraltar whose length will be respectively 850, 550 and 450 feet.

ABANDONMENT OF A SOCIAL EXPERIMENT.

Two schemes for insurance against want of employment have existed for two or three years past in Switzerland, one in the canton of Berne and one in that of St. Gall. The former was voluntary, but in St. Gall the laborer was compelled to insure. The American consuls at Chemnitz and St. Gall have both recently reported on the subject, and the former states that men whose work is steady and likely to continue so complain bitterly that they are compelled to support in idleness others whose labor is uncertain, but who, for that very reason, are better paid when they are at work. "It is not in the nature of things for such a system to succeed, even among so loyal, loving, and gentle a folk as the Swiss. The effort is not vain, if it will teach the thoughtless how hard it is to make laws or to institute any system that is to take the place of thrift and economy during the days when work is plentiful." Some time after this report the consul at St. Gall wrote that the experiment has been abandoned at the instance of the laborers themselves. He says they "found that a system which insured against loss of work resulted in the promotion of laziness and idleness. In fact, a knowledge of the existence of this system of insurance had drawn to St. Gall a considerable number of unemployed from other parts of Switzerland, with the object of obtaining support at the expense of resident laborers." Hence the system disappears on and after June 30 next.

THE GOVERNMENT'S SCIENTIFIC EXHIBITS AT THE TENNESSEE EXPOSITION.

The preparation of the exhibits to be made by the Smithsonian Institution and its dependencies at the Tennessee Exposition at Nashville is well advanced. The exhibit of the National Museum has not yet been fully arranged, but it will consist essentially of a representative exhibit taken from each of its numerous departments, and will probably be confined to this.

The collections of the Smithsonian proper will embrace a complete set of the publications, including the Half Century book, which latter great work will here be seen by the public for the first time, and will also include portraits of James Smithson and Thomas G. Hodgkins and a plaster model of Joseph Henry.

The Bureau of American Ethnology will concentrate its energies on a Kiowa camping circle, and this will be one of the most interesting features of the government's exhibits. The Kiowa Indians, together with an affiliated branch of the Apaches, have a highly elaborate social organization which is embodied and expressed in the grouping of their tepees and mode of camp life. All this will be exhibited in miniature and with great fidelity to nature. The exhibit will include all the objects of the handiwork of these Indians.

The National Zoological Park at Washington is to be reproduced with accuracy of detail in the form of a model about seven feet square, the work of a local modeler. Photographs of important features of the park, which is a very beautiful tract, including groups of animals, etc., will be shown.

The Bureau of International Exchanges, in the Smithsonian building, will exhibit a map of the world showing the number and location of its branches in all countries, these branches being in nearly every corner of the globe. One set of government documents will show the number of publications annually sent abroad, and this, together with a bound list of the foreign correspondents, will show how extensive are the bureau's activities.

The exhibit of the astro-physical observatory will be quite interesting, including, among other objects, photographs of the spectrum showing the progress of the observatory, photographs of apparatus, and the bolometer, the marvelous invention so invaluable to astro-physics. Prof. Langley's aerodrome, or air ship, will be shown only by photographs.

The exhibit of the United States Geological Survey will embrace two cases of minerals and a case of fossils. It will also include a suite of the rocks of the educational series. The last named is worthy of especial note. It is one of a number of duplicate suites, each consisting of 156 typical rocks which the Geological Survey has been preparing for a number of years, to be distributed to the great universities and colleges of the land for purposes of instruction. Its exhibition at Nashville will serve to announce its practical completion, as it will there be seen for the first time as an entirety. In addition to the above the survey will show twelve or fifteen relief models, most of them very fine, and a large collection of the topographic maps and geologic folios, as well as a number of transparencies and pictures of various kinds.

W. T. MORSELL.

BUSINESS CHANGES.

An elderly gentleman engaged in business for some twenty years past in New York and its vicinity, and which requires him to visit various lines of trade, said recently: "I find in the last few months that I am obliged to begin all over again. I go into a concern with which I have had dealings for years, and am surprised to find that the man with whom I have been transacting my business no longer sits at the desk. I ask for him and am told that he is no longer with the concern. Another, and in many cases a younger, man is there instead. It is almost like presenting my business anew. There is a perceptible interruption to relations, and an immense amount of new work to be done before I can get back to the position I occupied under the old management. This I meet almost universally. Some establishments have seized upon the present opportunity to rid themselves of dead wood. Others have hired cheaper help. Others have seen the opportunity of pensioning men long in their employ and superseding their somewhat old-fogy management by that of younger men up to date. Were I to tell you the number of cases in which these circumstances come to light, you would be astonished."—Business.

BAZIN'S ROLLER STEAMBOAT.

Dispatches from London, dated April 3, say that the reports of the recent trial trips of the roller steamer at Rouen have been discouraging, the engines not proving powerful enough. Their power was nearly trebled, but the increased weight submerges the rollers so deep that they only turn ten times a minute instead of forty. The rollers throw up such quantities of water behind that each acts like a brake and reduces the thirty knots an hour to six or seven. Rubber scrapers are being experimented with to prevent the upheaval of the water.

THE HON. BENJAMIN BUTTERWORTH.

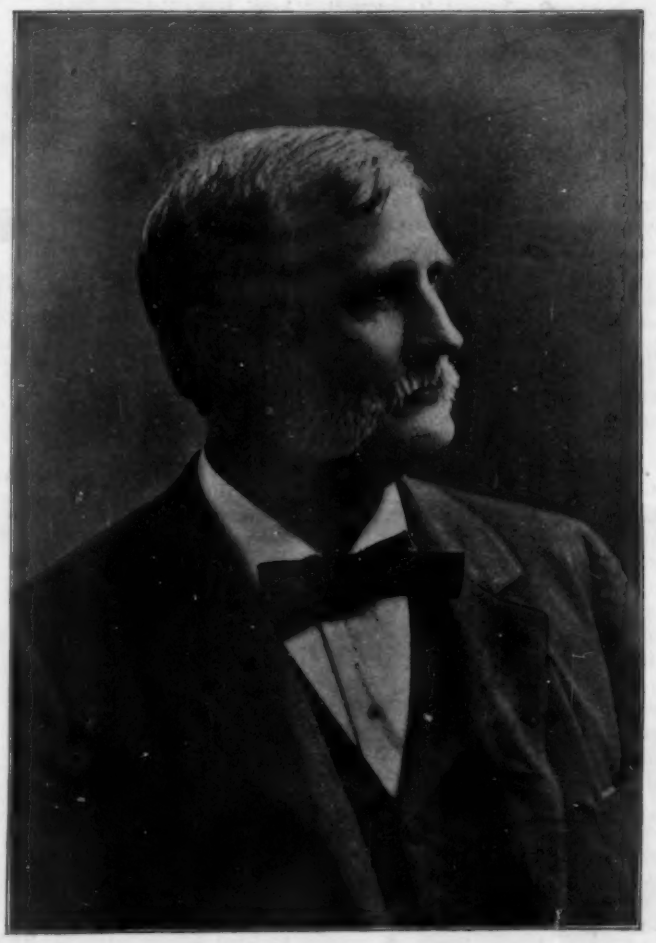
The appointment, and confirmation on April 6 by the United States Senate, of the Hon. Benjamin Butterworth to the responsible office of Commissioner of Patents will, we feel sure, receive the unqualified approval of all practitioners before the Patent Office.

The new Commissioner of Patents accepted the commissionership at the urgent request of President McKinley. Great pressure was also brought to bear upon Mr. Butterworth by the bar of the country without regard to politics, and it is not without considerable pecuniary sacrifice that he takes the position, for which he is so eminently qualified.

Mr. Butterworth is fifty-nine years old and was born in Ohio. He was admitted to the bar in 1861 and commenced the practice of law in Cincinnati. The first public position which he held was that of United States District Attorney for the Southern District of Ohio. He was elected a member of the Ohio Senate, and subsequently, in 1878, was sent to Congress from his district, which was normally Democratic. He was re-elected to the next Congress.

He was Commissioner of Patents during the administration of Chester A. Arthur and made a good record as an incorruptible and efficient commissioner. He served until he resigned to become a member of the Forty-ninth Congress. He was elected afterward to the Fiftieth and Fifty-first Congresses and declined the nomination for the Fifty-second Congress. While in Congress Mr. Butterworth was admittedly one of the readiest and ablest debaters on the floor of the House and was always the champion of good government and pure politics. Mr. Butterworth was president of the commission sent by the United States government to Europe, to induce the foreign governments to take part in the Chicago World's Fair. After terminating his connection with the Exposition, he gave his entire attention to the practice of law in connection with Mr. Julian C. Dowell. The law firm of Butterworth & Dowell have offices in Washington and Cincinnati. During his tenure of office as Commissioner of Patents Mr. Butterworth compiled a most comprehensive work on "The Growth of Industrial Art." This work gives the history of two hundred of the arts from the rude beginnings up to the most complicated examples of the modern inventors' skill.

Mr. Butterworth's deep interest in the promotion of all public enterprises, industries and inventions, his liberal-mindedness toward inventors and his influence with the representatives of the national legislature, all portend for good in the future, the possible reform of abuses and the placing of the Patent Office on a higher plane of usefulness.



THE HON. BENJAMIN BUTTERWORTH, COMMISSIONER OF PATENTS.

NO BIDS FOR ARMOR PLATE.

There were a number of surprised people at the Navy Department on April 8, when bids were opened for supplying the government with 8,000 tons of armor for the battleships Alabama, Illinois, and Wisconsin. It was the first opportunity of the department to test the attitude of the armor plate manufacturers with regard to the stipulation in the Naval Appropriation bill that the average cost of armor to the government should not be more than $300 a ton. Secretary Long presided at the opening of the bids, and he announced that one bid only had been received. When the so-called bid was examined, it was found to be in the form of two propositions from the Illinois Steel Company, a Chicago concern, neither of a regular character in conformity with the advertisement. Both of these propositions will be rejected.

The company offered to furnish the 8,000 tons at $300 a ton, on condition that Congress would award it a contract for the entire wants of the United States government for armor plate for twenty years. If this were done, the firm would furnish the material at $240 a ton, provided it did not have to manufacture less than 6,000 tons and more than 12,000 tons annually. The other proposition was curious. It contemplated the erection by the government of its own plant, the Illinois Steel Company to lease it the ground at a nominal figure for ninety-nine years and to furnish open hearth ingots suitable for armor plates.

What the government will do in view of the setback given by the refusals to bid has not been decided. Congress will have to untangle the knot. Meanwhile Secretary Long has reserved his opinion.

ACCORDING to Cosmos the following method has been adopted for testing the hardness of steel balls. A plate of glass is inclined to the horizontal and the balls dropped on this one by one from a definite height. The rebound of the ball, if properly tempered, is sufficient to carry it into the hopper, where the hard balls are thus automatically collected. Soft balls, rebounding less, fall into another receptacle.

THE POPULATION OF SWITZERLAND.

The population of Switzerland at the last census (1888) was 2,917,000, and the average increase of population from 1850–88 was 5·1 per 1,000 inhabitants. The same conditions, however, appear to exist in that country as in others, namely, that the population of the industrial districts increases, while that of the agricultural districts tends to decrease. According to the secretary of legation at Berne, the death rate averaged 17·6 per 1,000 in the towns in 1894. Influenza was responsible for 2,275 deaths, as compared with 2,669 in 1890, and only 268 in 1891. The average of deaths from alcoholism was 6·5 per cent of the total. In 1888 there were 229,650 foreigners resident in Switzerland, of whom 112,342 were Germans, 13,000 Austrians, 53,000 French, and 41,000 Italians. The English who come into the country, and who do so much to support the hotel industry, would seem therefore to be mostly of the tourist class, as there were only 2,577 residents. The emigration of Swiss has diminished from 13,502 in 1883 to 3,849 in 1894, and of these 3,285 went to the United States, of whom 1,273 were agriculturists. These official figures do not include the army of Swiss waiters and hotel servants who go abroad annually for the winter months, to the Riviera or elsewhere, and who return home for the summer tourist season. The average number of suicides per 100,000 inhabitants was 22·5, as compared with 7·5 in England and Wales. A curious coincidence in connection with suicides in Switzerland is that they are about 5 per cent higher on Tuesdays than on any other day in the week, and for men hanging, and for women drowning, appears to be the method of dispatch preferred by each sex.—Journal of the Society of Arts.

PRODUCTION OF RAIN BY GREAT FIRES.

In the early part of the century Prof. Espy excited great interest by his lectures on the formation of clouds, rain, and storms, and several, but not many, instances were quoted in which fires in the forest or canebrake were known to have actually produced local rains. An experiment made by Espy, near Washington, was not successful, and, indeed, it is conceded that a very moist condition or a generally unstable condition of the air is needed in order to produce a favorable result. It will, perhaps, be of interest to find that attention had been called to this matter before Espy's time. Thus, in the London Philosophical Transactions for 1708 (see Hutton's Abridgment, vol. v, p. 403) the Archbishop of Dublin says:

"There are three ways of reducing heath and bog to arable land (in the counties of Londonderry and Donegal): the first is by cutting off the scurf of the ground, making up the earth so cut in heaps, and when the sun has dried them setting them on fire; when burnt as much as they can be the heaps are scattered on the ground, and, after plowing, it produces barley, rye, or oats for about three years. The inconveniences of this method are (1) that the burning defiles the air, causes rain and wind, and is not practicable in a wet summer. . . . ."

It may be of historical interest to collect other references to the connection between large fires and subsequent rainfall, says the Monthly Weather Review.

PRACTICAL DIRECTIONS FOR SOLDERING ALUMINUM.

Opinions on the best method of soldering aluminum are always of interest, and the following communication from "Solderer" to the Metal Worker is pronounced by aluminum experts to contain some excellent practical directions for soldering aluminum. The "Solderer" says:

I notice the pictures accompanying the article on the "Specimens of Aluminum Soldering," but my attention, however, was more particularly attracted to the statement that the samples shown had not been subjected to the test of time, which has in a number of instances destroyed the hopes of those who thought they had successfully solved the problem of soldering aluminum by a simple method. I have not solved this problem, but have accumulated quite a bit of information on the subject, which may be of interest to those who are laboring in this field. When exposed to the atmosphere an electrical action or chemical action, as it is sometimes called, begins, and either the aluminum or the metals in the solder start oxidizing, which eventually results in a separation of the solder from the aluminum. This action is more rapid when aluminum has been used to manufacture a vessel to contain water. It can readily be seen from this that it is absolutely necessary that the surface of the aluminum must be thoroughly tinned, or protected as far as possible from atmospheric influence, in order to solder readily, and if the joint is to be a lasting one, the protection to the surface of the aluminum must be of a permanent nature. The difficulty in soldering aluminum has been to keep the surface entirely free from oxidation, the fluxes used in soldering other metals not being adapted for it.

Solders that are best adapted for use with aluminum contain a percentage of zinc, or spelter, and those who wish to demonstrate that aluminum can be soldered have only to use stearine as a flux with an ordinary soldering copper and a solder which contains a small precentage of zinc, or that has been prepared on purpose for soldering this metal. It is quite possible that those who are expert in the use of soldering coppers can tin the surface and solder the joint with half and half solder, with stearine as a flux. Those who have soldered tin plate, copper, brass, zinc, and black iron, know that black iron is much more difficult to solder, because the surface must be thoroughly cleaned from all oxide and made bright. Those who have had the most experience do not attempt to solder the iron until it is in a perfectly clean condition. From the fact that aluminum presents a bright appearance, it is too often assumed by those who experiment in soldering it that it may be readily soldered, while in fact as much care must be taken to have its surface perfectly clean as is taken in cleaning the surface of a piece of black sheet iron for soldering. Aluminum solder is made more durable and capable of standing the ravages of time by the addition of a percentage of silver, which immediately adds to the cost and also to the difficulty of soldering, as it must be done with a blowpipe or by some other means by which the high temperature necessary for melting and fusing the solder can be secured.

THE GUTTA-PERCHA CROP OF 1896.

The India Rubber World says: Advices from Singapore, dated November 20, record the shipment of gutta-percha, from the beginning of the year to that date, as follows:

	Piculs.	Pounds.
To Great Britain	94,231 =	8,320,800
To Europe (Continent)	15,366 =	2,048,800
To the United States	1,418 =	189,067
Totals	41,015 =	5,468,667

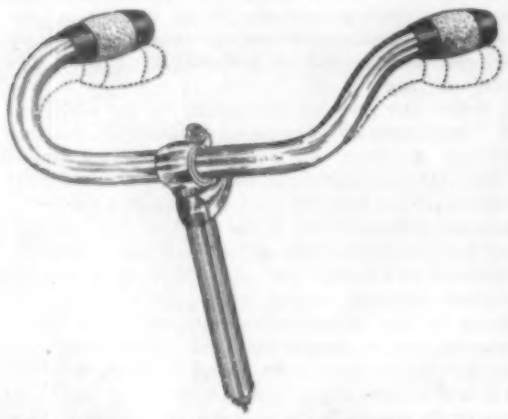
These figures, for a trifle less than eleven months, are larger than the total shipment of gutta-percha from Singapore for either of the years 1892 or 1893. Unless the shipments were at a larger rate during December, however, it is probable that the total for the year fell below that for most of the years during the past decade. England's share of the total is even greater for the period covered by the table than usual.

HISTORY OF THE AMERICAN LOCOMOTIVE.

The series of articles on the history of the American locomotive, which was announced to commence in the present number of the SCIENTIFIC AMERICAN, will be published in the SUPPLEMENT, the first of the series appearing in next week's issue of that journal.

A SPRING-SUPPORTED HANDLE BAR.

The bicycle rider generally finds that in riding over rough roads the most tiring effects are those which come from the jarring and jolting communicated to the body through the handle bar. This very commonly causes numbness of the hands or forearm, and the striking of some special obstruction often sends a shock through the entire body. It is on this account principally that the wooden handle bars have met



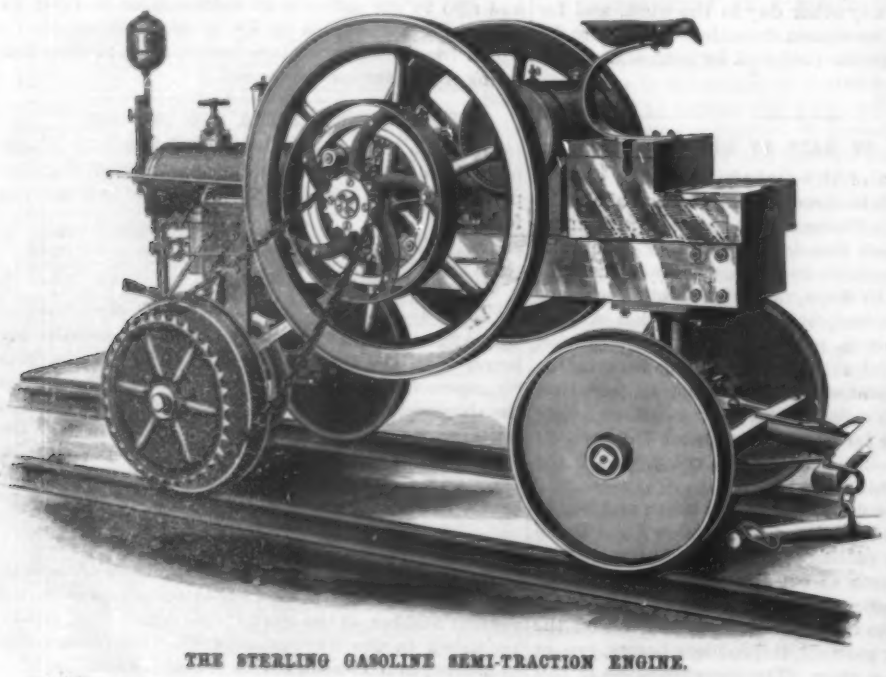
THE ROBINSON SPRING-SUPPORTED HANDLE BAR.

with favor, as being more resilient and "springy" than those made of metal, but the amount of added elasticity thus obtained is an undefined quantity, and cannot be made greater or less as may be desired, according to the weight of the bicyclist or his manner of riding. To overcome these objections, the spring-supported handle bar shown in perspective and in section in the accompanying figures has been invented and is being introduced by William Robinson, of the Devonshire Building, Boston, Mass. It was exhibited at the Boston bicycle show in February, and elicited general approval.

The handle bar proper has at its center an independent bracket, and the handle bar stem is similarly provided at its top with a bracket, the two brackets being hinged together to form a fulcrum, as shown in the sectional view, the hinge coming between the inwardly curved ends of the bar, or toward the rear of the machine. On the handle bar bracket is a lug projecting down into the tubular stem, and to this lug is hinged a rod at the lower end of which is a spiral spring bearing against an annular shoulder within the stem, there being nuts on the rod below the spring by means of which its initial compression may be adjusted as desired. As the weight of the rider is thrown suddenly, or resting normally, upon the handle bar in riding, the bar moves slightly upon its fulcrum, the spring absorbing the vibrations and the handle portions yielding as indicated by the dotted lines, thus obviating all shock and jar on comparatively smooth as well as on the roughest roads. This bar yields only to downward pressure, and in lifting, as in hill climbing, it is rigid—unlike the wooden handle bar, which is equally elastic in all directions. The spring is adjustable to any weight of rider, and the bar itself is adjustable in its bracket, and may be easily reversed, giving either an up or down curve to the handle bar. The construction described does not interfere in the least with the neatness and beauty of the handle bar, which is exceptionally handsome.

A SEMI-TRACTION GASOLINE ENGINE.

The illustration represents a novelty in traction engines, being a gasoline semi-traction engine which was last month shipped to Yucatan, for running a stone crusher and for use upon a tramway several miles long, upon which, however, it will be self-propelling in one direction only, having a tongue and attachments for hauling by team. It was built by the Charter Gas Engine Company, of Sterling, Ill. It has flanged wheels for use on the track, but the flanges are so low that they do not cut in very much when used on the road. The propulsion of the engine in one direction by its own power is effected through the sprocket chain connection of the main shaft with a sprocket wheel on one of the axles, as shown in the illustration. This engine has the general features of the Charter gasoline engine, which has been many years on the market, the use of gasoline direct from the tank being so controlled as to secure perfect immunity from danger of fire and explosion, while unaffected by changes of weather and temperature. The driving pulley is a friction clutch pulley, simple in construction, and with means for taking up the wear of the clutch shoes, which are lined with hard wood. The machine that is being operated can be stopped and started at will, while the engine continues to run. Mufflers for the exhaust reduce the noise, so there is not as much as is made by the steam engine exhaust. The gasoline tank has capacity for over a day's consumption, and is shown in the cut.



THE STERLING GASOLINE SEMI-TRACTION ENGINE.

Cigar Ribbons.

One New York firm alone turns out yearly an average of more than $200,000 worth of cigar ribbons and on these employs nearly 500 hands, says the New York Sun. Until 1868, it is said, cigar ribbons were not manufactured here. The use of silk ribbons to tie up cigars originated in Cuba. The Spaniard's patriotism impelled him to choose the national colors of red and yellow, and at the present time these two colors, separate or in combination, are still the favorites. The first ribbons were made in Barcelona and were the rich crimson-scarlet, known as the Figaro, the vivid yellow of the Cabanas and Partigas, and the red and yellow of the Española.

The first domestic ribbons made were of cotton, of a pale yellow, with a brown stripe running down the center, and this was speedily followed by a ribbon made wholly of silk. In 1868 a cigar manufacturer in this country conceived the idea of having his name printed on the silk ribbon, which had hitherto been plain, and also the shape of the cigar. This was at first done in black, then in colors, and eventually in silver and gold, with embossed work and coats of arms. Then the name was woven into the ribbon instead of being printed. Woven ribbon is very valuable as a trade mark, since it is impossible to duplicate it in small quantities.

In 1868 the first ribbon factory was established in this country by a man named Wicke, who established a small factory near the East River. It was operated by two Swiss. The demand for the ribbon increased, and in 1870 the profits were so good that a four-loom factory was started and operated by Swiss weavers especially imported. Only two widths of what is termed "Londres" ribbons were then made. In 1887 there were more ribbons used in proportion to the total number of cigars manufactured in this country than in any other year, and since then the bundling of cigars has steadily decreased in favor of the system of packing twenty-five or fifty in a box without ribbons.

The raw silk for the ribbons is imported direct from Japan and China. There are ninety-four styles of cigar ribbons made, varying in width from one-eighth of an inch to an inch and a half. United States ribbons are sold in Canada in preference to the English make, although the duty on our goods is heavier. Some of the machinery is very interesting, especially that used for weaving in the name of the firm in black.

Some years ago the general public was bitten by a cigar ribbon fad and many ribbons were sold by cigar dealers to make lambrequins, sofa cushions, etc. A woman in New Haven made a table mat of 450 separate ribbons and it fetched $160, while a cushion made by a cigar manufacturing firm as a compliment to an actress, whose name was used as a trade mark, cost $250 simply for the needlework and time expended on it.

THE DENSMORE TYPEWRITER BALL BEARING TYPE BAR JOINTS.

One of the latest to be introduced and one of the most valuable of the improvements which have marked the history of the Densmore typewriter is the ball bearing type bar joint, shown in the accompanying illustration. Fig. 1 is a side view of the type bar and its hanger, with the depending key rod, and Fig. 2 is a larger view of a portion of the hanger, both views showing the five balls contained in the ball case on one side of the type bar pivot. A longitudinal sectional view of the type bar joint is shown in Fig. 3, there being five balls on each side of the pivot, and the joint thus has ten of these hardened balls. The arrangement prevents wear at the bearings, upon which perfect alignment and durability of a machine chiefly depends. The key rod, as will be seen, is pivotally connected with the short arm of a compound lever pivoted adjacent to the type bar joint, while the longer arm of this lever embraces and slides on the type bar during the stroke, as one's hand slides on an ax helve in chopping, thus gradually overcoming the inertia of the type bar. The gradually accelerated speed and force thus obtained, with the least effort of the operator, account for the very light stroke of the Densmore typewriter, while the compound lever and its bearings receive all the lateral strain, so that there is practically no wear or play. The ball case is adjustable, but is screwed very firmly into place, and will rarely need taking up even after long use. There is shown in the window at the main office

THE DENSMORE TYPEWRITER BALL BEARING TYPE BAR JOINTS.

of the Densmore Typewriter Company, 316 Broadway, New York, a type bar and connections complete of heroic size, the type bar being eighteen inches long and the balls nearly half an inch in diameter. The hangers are numbered, each hanger having tenons which fit accurately in mortises in the top of the frame, where they are firmly screwed in place, and this, with the delicately exact construction of the type bar joints, gives the machine an accuracy of alignment which does not depend upon the occasional adjustments of a repairer, but which must stay, because the type bar joints do not wear out and the hangers cannot become unadjusted.

The Densmore has comparatively few parts, is of light weight and easy to operate and very convenient to handle or carry. It has attained its great success from the thorough excellence of its manufacture and the many advantages and conveniences it possesses.

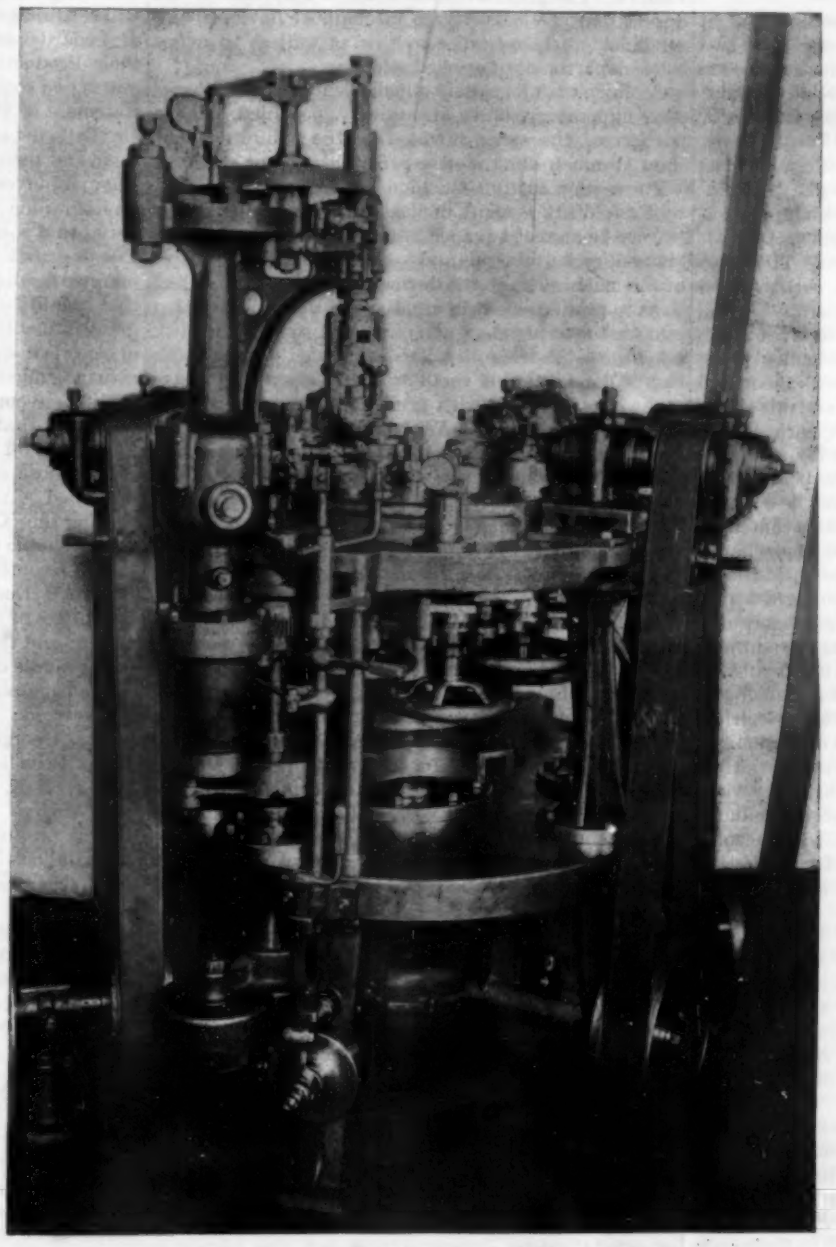
Carborundum Production and Use.

The Carborundum Company reports to us that its works have produced during the year 1896, in round numbers, 1,191,000 pounds, or 595½ tons, of crystalline carborundum, says the Engineering and Mining Journal. Consideration at the present is given to the production in crystalline form only, but another important industry in which carbide of silicon promises to be a valuable adjunct will naturally increase the usefulness of the material. Some mention has been made of the experiments showing that carborundum can be used, and will, in all probability, take the place of ferro-silicon in the manufacture of steel. Prof. Luehrmann, of Germany, recently wrote an article on this subject, indicating that in the use of carborundum there will be in Germany alone, approximately, 2,500 tons consumed annually, provided its cost would not exceed six cents per pound. It may be used for this purpose in an amorphous form, and the Carborundum Company is prepared to furnish it at a price slightly under this figure.

A NEW AUTOMATIC MILLING MACHINE.

The illustration represents a machine which is well worth the attention of manufacturers of all classes of goods on which hexagonal milling is an important item of expense. The machine was designed and built by James Gregory, of Bridgeport, Conn., to whom a patent was recently issued therefor. It mills the hexagonal surfaces on the different parts of steam valves and other similar work, and its operations are so completely automatic that the operator needs only to place and clamp the parts to be milled, when they are passed from one mill to another, presenting a new face or surface to each successive cutter until all the faces are milled. At the last stop, after being automatically loosened, they are taken by the jaws of an unloading mechanism, after unscrewing which the finished articles are dropped into a receptacle.

The machine has an intermittently rotary table, eight movements of which constitute a complete rotation. The table has holders to retain the hubs to be milled in their proper position during the several cutting operations on the hubs by the millers, which are stationed at equal distances apart on the frame of the machine, each serving to mill off a special surface. In the time of one movement of the table, the operator, standing in front of the machine, sets a hub upon a holder, and sets the hub at a proper angle with respect to the cutter, by means of a tool provided for that purpose, after which, on moving a handle, the table is rotated to carry the hub to the first one of six milling stations, where the cutter operates to mill off one of the outer surfaces of the hub. During the time of this milling the operator has placed a second hub on the holder, then at the front station, after which the table again rotates automatically an eighth of a turn, carrying the first hub to the second milling station and the second hub to the first station, the hubs being slightly turned between the stations to insure the proper engagement of the cutters with their successive surfaces. The operation is continued in this order, by the rotation of the table, until the six surfaces of the first hub have been milled, when the next movement brings the first hub beneath the gripping head by which its removal is effected, the operation being simultaneous with the work of the several cutters on the heads that have been successively placed in position. As the hubs are thus removed from the holders the latter are left free to be immediately supplied with additional hubs. The cutters are easily adjusted for different sizes of hubs, and the construction and operating mechanism of each of the eight holders and six cutters are substantially duplicates of each other. The operator easily feeds to the machine hubs of ordinary sizes at the rate of about three hundred an hour, and the milling is the final operation, the finish being of a superior character. The machine from which our illustration was made has been running nearly two years, a good portion of the time night and day, without other expense than the wages of unskilled laborers to operate it.



THE GREGORY AUTOMATIC MILLING MACHINE.

A Curious Manufacturing Establishment.

In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1079, for September 5, 1896, will be found an article entitled "An Industrial Democracy," which gives an interesting picture of the establishment for training salesmen.

Probably no industrial institution in the world offers more unique features than does this plant and the method by which the business is conducted. Aside from the manufacturing part of the business, great attention is paid to the systematic training of employes. Usually the salesman is a person who is given a sample of the article which he is intended to sell, and he is sent out among prospective buyers to work out his own salvation; but the proprietors of this manufacturing company determined that salesmen should be as carefully trained as professional men, and to this end they have devoted a great deal of time and expense. The school for salesmen is situated in the upper part of the factory, and is fitted up with a small theater, the seats arranged in a circle, and a stage is provided which represents the office of the business man or any kind of store, as a hardware store, candy store, grocery store, etc.

The man who wants to become a salesman may take up a course in this school, at the company's expense, and, while sitting in the auditorium, he is enabled to see how a thoroughly skilled salesman approaches a probable purchaser and how he overcomes the objections which the merchant is almost sure to bring up. Then, in turn, the embryo salesman is required to take his place upon the stage and thus learn confidence and tact while he is watched by expert critics who are able to make friendly suggestions or criticisms when they are needed. The places at the side of the stage are filled with what appear to be store windows, which are utilized to display goods of various samples, so as to familiarize the salesmen with the art of window dressing, in order that they may make valuable suggestions to customers. It is little wonder that, under this system, salesmen which are turned out are able to act successfully as agents for the establishment which employs them.

The Armies of Europe.

An editorial article in the London Spectator has the following characterizations of the armies of continental Europe:

"The vast armies of the Continent, which seem on land so irresistible, have all, like our own small army [the English], their points of weakness, differing in each state, but still well known to those who pass their lives studying their qualities. The German army is, as a fighting machine, probably the most perfect of all, but as Count von Moltke said, it has never been tested by retreat; it rests on universal conscription, which sweeps the unwilling as well as the willing into the military net, and it is of necessity commanded by the Emperor, who must take part in the campaign, and who may or may not be competent to choose rapidly among the best plans, or to select the generals most competent in actual warfare. It is difficult even to imagine the total defeat of the wonderful machine, worked up as it has been for thirty years, but its real trial would come when it had to conquer in another and greater Zorndorf another Russian army equal in numbers to itself, and resolved to perish on the field. The Russian army, matchless in numbers and perfect in obedience and courage, is composed of underfed men, who, either from that cause or some special physical liability, perish when in movement in astounding numbers, and, once outside Russia, have a positive habit of dying. Army after army of Russians has withered away in the Caucasus and the Balkans, and there is no proof that the cause of the evil, be it economy of supplies or corruption in their distribution, or a certain want of cheeriness which is deep in the Slav character, has as yet been removed. The Russian army, irresistible in defense of Russia, is not, as the last war with Turkey proved, equally formidable in offensive operations. The Austrian army, though splendidly organized, and with perhaps the finest cavalry in the world, thinks in too many languages, has too many kinds of patriotism, and is governed too exclusively by a caste which has often failed in developing enthusiasm in the soldiers it educates and commands. The Italian army has not the confidence which comes from a history of victory, and its history in Abyssinia seems to show that, while it will face anything, its leaders are unaccustomed to separate responsibility, and depend on the commander-in-chief, who may or may not be equal as a strategist to his position. Finally, the French army, with its new and complete organization, its hundreds of thousands of brave men, and its ardent generals, is still embarrassed by certain sources of weakness. The supply departments are still, it is believed, infested with jobbery in the management of the great contracts, the huge mass of officers still includes many who are inefficient, and the Minister of War, General Billot, has recently made a speech to a syndicate of military journals which reveals with amazing frankness some other mischiefs. Very short service does not quite suit the genius of the French people, who, quick to learn and eager in combat, are not equally ready to perceive the necessity of machinelike discipline. It takes them time to learn perfectly to obey, or, as General Billot puts it, we must remember 'the fact that the temperament of the German nation is more naturally inclined to those ideas of discipline and obedience which are not possessed by our young Frenchmen, so intelligent, so brilliant, but—let us confess it—so giddy and thoughtless. And while we must ever bless the French revolution, which has so thoroughly made us men and citizens, I cannot help remarking that, from a military standpoint, the revolution has made the task of the instructors of the army a very heavy one—the task of subjecting to the yoke of discipline men for whom the idea of liberty has become a dogma.'"

Experiments in Military Ballooning.

A series of experiments are being made at Shoeburyness by the officers of the ordnance department and the superintendent of experiments at the school of gunnery on the one hand and the officers of the school of military ballooning at Aldershot on the other, says Public Opinion. A captive balloon was sent up over the Estuary of the Thames, attached by a cable of about 700 yards to a boat loaded with ballast, which was set adrift on the water. The weather was somewhat boisterous, and the morning dull and hazy. The field piece was placed on the marsh land beyond the school of gunnery, from where the firing took place. The distance or range was ascertained to be about 4,000 yards. The gun was worked by the staff of the school of gunnery, under the direction of Major Hickman, R.A., assistant superintendent of experiments. Shrapnel shell was used, and good practice was made from the first. On the sixth round, however, excellent elevation and direction and distance were obtained, and the shell was observed to burst almost immediately over the balloon. After oscillating for a few seconds, the balloon was observed to be collapsing, and then it gradually fell. Its descent was slow, and, as far as could be judged, had the car contained any occupants, it is possible they would have sustained but little, if any, injury had the balloon fallen on land. When it was seen that the balloon had been injured and was descending, the boat to which it was captive was picked up and towed to land, and the balloon was packed up and later in the day sent back to Aldershot. It was impossible to ascertain the extent of the injury which was done to the balloon itself, but the wicker car appeared to have sustained little or no damage. The experiments were at once suspended, and a report was drawn up and forwarded to the war office.

ON the western bank of the Nile Medinet Habu has been disincumbered of the rubbish under which it was buried and now stands out in all its magnificence.

NEW YORK ACADEMY OF SCIENCES.

ANNUAL EXHIBITION AND RECEPTION.

The fourth annual reception and exhibition of the New York Academy of Sciences was held in the American Museum of Natural History, on the 5th and 6th of the current month, and the presence of several thousand people testified to the value of the event and the interest taken it. This year the exhibits were limited to the exhibition of the progress made in science in the past year, and it enhanced greatly the scientific interest of the exhibition, while enough popular matter was shown to occupy far more time in its inspection than many of the guests were able to devote to it. Even such cultured assemblages as were present at the three sessions of this exhibition showed the interest aroused in the average human mind by something in motion, and the rock cutting machine, the exhibit in experimental psychology, the two booths in which new Roentgen X ray apparatus was at work, and the electrical furnaces had crowds of people around them all the time. Three sessions were held, that on the evening of the 5th being assigned for members of the academy and guests, while the sessions of the next day were open to the general public and members of the Scientific Alliance and of the museum.

Fourteen departments of science were represented in the exhibition, and a catalogue comprising sixty-two printed pages was needed to enumerate the articles exhibited. The electrical section was especially strong, and its exhibit formed one of the striking features of the reception. A collection of incandescent lamps showed the advances made from the first crude forms to the present 230 volt high efficiency lamps. The oldest one shown was Edison's paper horseshoe lamp, which was described in the SCIENTIFIC AMERICAN, April 17, 1880, and is still in good working condition. The question of producing electrical energy from carbon without the application of heat is one that is always in the minds of electricians, and that always receives much thought. One method of solving the difficulty is by using the Jacques carbon battery, in which carbon and iron are placed in caustic potash (KOH) and air is admitted for a supply of oxygen. The apparatus was shown. The new and improved forms of Roentgen ray tubes and coils in operation in one of the booths were powerful enough to show the shadows of the bones of the human body, though most of the visitors contented themselves with taking a good look at their hands by means of the fluoroscope. One of the curiosities of the electrical department was one of the great porcelain insulators, ten inches in longest diameter, used on the Niagara-Buffalo transmission line to support wires between which exists a pressure of 10,000 volts.

In the chemistry section there was a supplement to the electrical exhibit in the shape of several electrical furnaces, two of which were constantly in operation. In one of them quartz (a mineral until recently regarded as wholly infusible) was shown in a molten state, while the other was used for showing the spectra produced by dropping an appropriate metal into the arc, according to the method of Roberts-Austen. An interesting series of chemical compounds produced by the aid of the electric furnace was on exhibition. The heat developed in these furnaces is estimated to be as high as that developed in the sun (3,500° to 4,000° C.) The furnace used by M. Henri Moissan when he made diamonds before the academy last October was on exhibition, and the great carbons, 3½ inches in diameter, like those used in the aluminum works at Niagara Falls, attracted some attention. A display of the Tiffany favrile glass was made in this section.

The most popular feature of the section devoted to botany was a collection of one hundred water color paintings of Australian wild flowers. These were done from life in their native haunts by Mrs. F. C. Rowan, by whom they were loaned to the reception. Their marvelous fidelity to nature, combined with their artistic merit, have won twelve gold medals at various places from Melbourne to Paris and Amsterdam. A grewsome exhibit in the botanical section was a series of bacteria from our city water. Fortunately, most of them are entirely harmless.

Improved methods of installing exhibits of an archæological character were shown in a model of an altar mound excavated near Chillicothe, O., last year, showing the manner of doing the work, and in a skeleton mounted in exactly the position in which it was found and surrounded by the personal ornaments which were originally buried with it. The exhibit in the archæological department which seemed to attract the most attention was a selection of specimens illustrating recent discoveries at the ruins of Omitlan, state of Guerrero, Mexico. The ruins cover a large area and were discovered by Mr. William Niven, in a region that has never been visited by any of the famous explorers and of which no mention is made by any of the Mexican historians. Many of the antiquities found are of unusual form, but most of them have apparently been used as dress ornaments, amulets, ceremonial stones and the like. Seventy mother-of-pearl buttons and pendants were found in a small olla or pot of terra cotta nine feet below the surface of the ground in a temple. These were exhibited, a portion of them still remaining in the clay which filled the olla. Dozens of highly polished idols of jade, diorite and serpentine and ear ornaments of the same materials, together with masks of trachyte, marble, chert and jade, were on exhibition. One shell object was marked as being an ear ornament, but it bore a closer resemblance to an ordinary napkin ring. A series of fine photographs showed portions of the ruins and the laborers at work. Some 1,400 objects comprise this unique collection, which is now on permanent exhibition in the American Museum of Natural History, having been acquired by that institution. Inasmuch as the Mexican government has just granted to Mr. Niven the right of exclusive exploration in these and other ruins in Guerrero for ten years, under certain conditions, we may reasonably hope for the display of additional material from this wonderful ruined city at future receptions of the academy.

Experimental psychology is a department of science which is receiving much attention now from students and has its strongly popular side. The delicate and ingenious devices for determining the strength, duration and effect of various sensations, the quickness of perception, and other mental processes were in operation at one table and aroused much interest in the visitors. The great advances made of late years in the application of electricity to mechanical devices have rendered great assistance to this as well as to every other department of applied science.

Geology, with its closely allied sciences of physiography, mineralogy, and paleontology, occupied a large portion of the space devoted to the exhibition and showed much that was new in material or method.

The section cutting machine devised and exhibited by Prof. W. B. Dwight, of Vassar College, Poughkeepsie, marks a great advance in this important aid to the study of rocks, minerals and fossils. The special features of the machine lie in the devices for holding the object so as to produce a cut in exactly the desired direction and for the adjustment and control of the cutting disk by adjustable friction rollers, so that the sectioning can be done by either small or large disks (six to twelve inches in diameter) with great accuracy, facility and economy of material. With this instrument can be cut sections of from eight to twelve square inches and from $\frac{1}{10}$ to $\frac{1}{100}$ inch thick with very true, smooth surfaces.

Progress made in physiography was shown by the display of recently completed maps, charts and topographic models, one of New York City being of special interest.

Paleontology, both vertebrate and invertebrate, showed that its devotees had not been idle the past year. Mounted and unmounted skeletons of marvelous perfection of mammals from the Tertiary lake beds of South Dakota and Wyoming were exhibited as some of the results of last year's expeditions. One of the most important features in this section, from a scientific point of view, was a series of specimens from New Mexico which revealed to Dr. J. L. Wortman the fact that the order of edentates or sloths originated on this continent in early Eocene time, instead of in South America, as has long been supposed to be the case.

Prof. S. H. Scudder, of Harvard University, contributed to the reception a selection from his celebrated collection of Tertiary insects from Florisant, Colorado, some of which are still undescribed and without names. All the principal orders were represented and in considerable variety. Prof. C. E. Beecher, of Yale University, exhibited a set of models of trilobites which gave the results of infinite study and pains. Trilobites are crustacea and may be regarded as the ancestors of the modern lobsters, shrimps and crabs.

In the mineralogical section the most striking specimens were a group, 20 × 13 × 13 inches in size, consisting of three golden calcite crystals and another somewhat larger group consisting of very large crystals of calcite, galena, copper pyrites and zinc blende on chert. These were from a new lead and zinc mine near Joplin, Missouri.

In the physical department Prof. O. N. Rood exhibited a series of photographs demonstrating the regular reflection of the Roentgen. Among many other objects of interest in this department, mention may be made of the ingenious device gotten up by Mr. P. H. Dudley for the purpose of learning the amount of depression of railroad rails under moving trains. It is an electrical contrivance which is firmly attached to the base of the rail in such a way as to register automatically the elongation and compression of the rail as the train passes over it. Experiments with this little instrument prove that the deflecting pressure on a rail from a moving train is from ten to twenty times as great as was calculated from theoretical considerations.

The plans of the zoological and botanical buildings to be erected in Bronx Park were on exhibition.

A portion of Tuesday evening was devoted to addresses by Prof. R. E. Dodge, chairman of the reception committee, Prof. J. J. Stevenson, president of the academy, and Morris K. Jesup, Esq., president of the American Museum of Natural History, and a lecture by Dr. Nicola Tesla. Prof. Stevenson dwelt upon the fact that the past year had been a memorable one in the history of science in New York City. The Botanical Garden is well under way, the Zoological Garden is an assured fact, and the Natural History Museum has made great enlargements in its building and more are provided for to complete the south front. Private munificence toward all these enterprises has been very great. The scope of the Academy of Sciences has been broadened by the establishment of a section of anthropology, psychology and philology, bringing the association a long step nearer to the older academies of science in Europe. The publications of the academy have been larger and more numerous than ever before, and show the active scientific work that is being carried on under its auspices. Mr. Jesup outlined the status and plans of the great museum in which the reception was held, and spoke of the close relations existing between it and Columbia University, the city Board of Education and the State Department of Public Instruction in the work of popularizing and disseminating scientific knowledge. The growth of the museum and related institutions in the last ten years has done much to remove from New York the stigma of being a purely commercial city, caring nothing for science, literature and art. Every exhibit in the museum was plainly labeled, giving information about the object, rendering a catalogue unnecessary.

The subject of Dr. Tesla's lecture was "The Streams of Lenard and Roentgen, with Novel Apparatus for their Production," and was illustrated by many diagrams and some apparatus. After a brief but concise statement of what is known about the so-called X rays, Dr. Tesla detailed some of his own experiments with them and their production. Toward the close of 1894 he began an investigation into the effects upon covered photographic plates produced by Crookes tubes, and found that some affected the plates and some did not. The destruction of his laboratory interrupted his experiments, and Roentgen's announcement came before they could be taken up again and completed. One great difficulty in the way of success with some lines of electrical study has been to get a machine which will give a sufficient frequency of vibration. Now this problem seems to be solved. Dr. Tesla's latest discovery is that a particular form of the electric arc light gives off X rays which produce results far superior to those emanating from Crookes tubes. He also described a method he had lately discovered of deflecting the X rays by means of magnets and magnetism so simple that any boy could do it.

The reception and exhibition committee this year was R. E. Dodge, H. F. Osborn and C. F. Cox; special committee of arrangements, J. L. Wortman and G. D. Orner; and the chairmen having in charge the special departments of the exhibition were: Anatomy, George S. Huntington; astronomy, J. K. Rees; botany, L. M. Underwood; chemistry, Charles A. Doremus; electricity, George F. Sever; ethnology and archæology, Franz Boas and M. H. Saville; experimental psychology, J. McK. Cattell; geology, J. F. Kemp; mineralogy, George F. Kunz; paleontology, Gilbert Van Ingen; photography, William Stratford; physics, William Hallock and J. F. Woodhull; physiography, R. E. Dodge; zoology, C. L. Bristol and Bashford Dean.

The officers of the academy for 1897-98 are: President, J. J. Stevenson; first vice-president, H. F. Osborn; second vice-president, N. L. Britton; corresponding secretary, William Hallock; recording secretary, J. F. Kemp; treasurer, C. F. Cox; librarian, Arthur Hollick.

The American Coal and Iron Production in 1896.

According to statistics prepared by the Engineering and Mining Journal, of New York, the output of bituminous coal in the United States during 1896 reached a total of 141,770,099 short tons (2,000 pounds), showing a gain over 1895 of 4,371,732 tons. On the other hand, there was a decrease of 6,782,057 short tons in the anthracite production. The total coal production was, therefore, 193,351,027 short tons, and the total decrease, as compared with 1895, was 2,410,305 tons. The production of coke showed a gain of 445,276 tons, chiefly due to the activity of the iron and steel trades in the earlier part of the year. The price of coal continues very low, the average for bituminous coal at mines being below $1 per ton. The production of pig iron last year was 8,768,869 long tons (2,240 pounds). The depression in business which made itself manifest in the latter part of the year had less effect than might have been anticipated, the decrease from 1895 being only 677,439 tons, or about 7 per cent.

New Deputy Commissioner for Canada.

In a recent issue we announced the death of Colonel Richard Pope, late Deputy Commissioner of Patents for the Dominion of Canada. A successor has just been appointed in the person of Mr. William Bain Scarth, ex-Member of Parliament, who will fill the dual positions of Deputy Minister of Agriculture and Deputy Commissioner of Patents, reverting to the old system previous to 1888, when the late Chevalier Taché, M.D., held the above important offices. Mr. William J. Lynch, Financial Clerk, has been appointed Chief Clerk of the Patent Office, vice Mr. J. F. Dionne, resigned.

Recent Patent and Trade Mark Decisions.

Klein v. City of Seattle (U. S. C. C. A., 9th Cir.), 77 Fed., 200.

Insulating Pins.—The Klein patent, No. 297,699, for an improvement in pins for holding insulators for electric wires, consisting of making the pin of wrought metal, with a soft metal head adapted to be screwed into the insulating material, has been held void for want of patentable novelty.

Extensive Sales as Evidence of Invention. —The fact that a device has gone into general use, displaced other devices, while in some cases evidence of invention, is not conclusive of patentability; where the changes made over the prior art are mere changes of mechanical construction or of form, size or materials.

McDowell v. Kurtz (U. S. C. C. A., 3d Cir.), 77 Fed., 206.

Protection for Pipe Threads.—The Kurtz patent, No. 140,168, for a band or ring to protect the screw threads of pipes, has been held valid and infringed on motion for preliminary injunction.

Public Acquiescence.—Where plaintiffs have manufactured and sold their device without opposition for more than five years, there is sufficient proof of public acquiescence, and it is immaterial that a large number of other devices were not marked "Patented" when it appears that enough were so marked to give general notice of the patent.

Cleveland Faucet Company v. Syracuse Faucet Company (U. S. C. C. N. Y.), 77 Fed., 210.

Hydraulic Air Pump. — The Weatherhead patent, No. 504,097, has been held valid as showing patentable invention and infringed by a pump containing a mechanism which accomplishes a similar result in the same way, although it differs in the construction somewhat.

Matheson v. Campbell (U. S. C. C. N. Y.), 77 Fed., 280.

Color Compounds.—The Hoffman and Wynburg process and product patent, No. 345,901, for the naphthol black color compounds, have been held valid and infringed on rehearing.

Anticipation.—Where it is shown that a coal tar dye, similar to a dye covered by a process and product patent and answering to the chemical tests of the patent, was on sale in this country prior to the application, it does not amount to anticipation of the patent, where it appears that it was made from a different starting material, was inferior in quality, and was sold at a higher price.

Validity of Product Patent.—Where a patent first describes a new patentable process, producing an article chemically and technically identical with an article formerly known, but superior thereto, the invention is a meritorious one, and the claim on the product will be held valid as well as the claim on the process.

Burden of Proof of Infringement of a Process Patent.—The complainant has shifted the burden of proof resting upon him as to infringement of the process patent when he has shown that the defendant's product corresponds with that claimed in the patent when subjected to chemical tests, and then the burden is upon the defendant to show that it was made by a different process.

Heaton Peninsular Button Fastener Company v. Eureka Specialty Company (U. S. C. C. A., 6th Cir.), 77 Fed., 288.

Sales of Patented Machines with Conditions Limiting Their Use.—It is lawful for the owner of a patent for a machine to sell such machines subject to a condition that they shall be used only with a certain article manufactured by the seller, and that, in case of a breach of the condition, the title shall revert to the original owner. This is true, although such articles which must be used with the machine are not patented, if such restriction gives the owner of the machine patented a monopoly of their manufacture and sale. This is not void as in restraint of trade or against public policy, for the purchaser of the machine is a mere licensee, and the breach of the condition would not only be a breach of the contract, but a violation of the monopoly, for which an injunction would lie. In such case, too, it is immaterial that the patent owner sells the machine through jobbers and not directly to the users where the machines bear a conspicuous metal label with the conditions of the sale thereon and all parties have notice of it. Where, for example, machines for fastening buttons on shoes are sold by the patentee on condition that only staples made by said patentee, although not patented, shall be used therein, any other party will be enjoined from selling staples which are intended to and can only be used in such machines, for he is guilty of contributory infringement. And in such case it is immaterial that the defendants did not use the patented machines or that they are making and selling an unpatented article.

International Tooth Crown Company v. Bennett (U. S. C. C. A., 2d Cir.), 77 Fed., 313.

Artificial Teeth.—The Low patent, No. 238,940, for a device for permanently inserting artificial teeth without a plate and without using the gum as a support, was held void as to the first two claims.

Archæological News.

A life sized bronze statue of Poseidon was recently discovered in the sea near Mount Cithaeron by a fisherman. Though it is badly rusted, the head is untouched and only the hands are missing. Near it was a splendid marble pedestal with an inscription. The statue is assigned to the sixth century before Christ by archæologists, who say it is as fine as the Jupiter Olympus found at Delphi.

Cologne has been celebrating the carnival by a historical and artistic procession around the cathedral, including young women who represented St. Ursula and her eleven thousand virgins, the town tower, and the mercenaries employed by the archbishops when they were secular princes. It is asserted that the carnival has been held at Cologne since pre-Christian times and that it is the direct representative of the Roman Saturnalia.

Edmond de Goncourt's Oriental china, for which he and his brother spent 400,000 francs, brought 237,046 francs at the recent sale in Paris. His eighteenth century drawings, however, were sold for much more than he paid for them. So far the collections have brought in 1,162,352 francs, and there are four more sales to come, but the sum is much smaller than was expected, and the Goncourt Academy will be poorly provided for, even if the will is held valid by the courts.

The Romanesque tower with its Roman foundations at the entrance to the mausoleum of Diocletian, at Spalato, in Dalmatia, has been destroyed. A new structure is taking its place. Fragments of capitals, sculptures, and stones that date from the third to the twelfth century are lying about the ground; some of them are being built into the new structure which is taking the place of the old. This is not very likely to make Dalmatia as popular a place of resort for the tourists as Italy or Sicily, and if the antiquities of this interesting region are to be rebuilt in this wholesale manner, it will not tend to encourage visitors.

M. Berthelot has recently published in the Comptes Rendus analyses of weapons, tools, etc., from Tello, in Chaldea. Their date is put from 4000 to 3000 B. C. A large lance and a hatchet were found to be approximately pure copper, and another hatchet was of copper with traces of arsenic and phosphorus, by which it seems to have been hardened. No trace of tin was present in any case. Thus in Chaldea an "age of copper" seems to have preceded the "age of bronze." An egg-shaped object from the same locality, weighing 121 grains, was of iron; an ingot of white metal was 95 per cent silver; a leaf of yellow gold was found to contain considerable quantities of silver.

Prof. Thomas D. Seymour, chairman of the managing committee of the American School at Athens, says that on account of the threatened war the excavations projected by the school this season at Corinth, and perhaps elsewhere, will not be undertaken. The Corinthian excavations, on account of the great depth and the purchase of valuable land, would this year have meant a considerable undertaking, and the government has had no time to give to the matter of expropriating land and superintending the work. At this season of the year it is always somewhat difficult to obtain laborers, and this year, with the demand on the men for service in the Greek army, the effort to hire them would be useless.

The lake village of Glastonbury, England, is very interesting. During the last year fifteen additional dwelling houses and 500 feet of palisading have been disclosed, and nearly two-thirds of the boundary have now been unearthed. According to the Academy many valuable relics have been obtained, among them being a saw, a wooden ladder seven feet long, a small door, and a mirror—a feature of late Celtic art. The pottery was abundant and was ornamented in late Celtic style, uninfluenced by Roman art. Hence, the discovery of this lake village cannot fail to shed much light upon one of the obscurest periods of British art. The discovery is of great importance, for it reveals the manner and avocations of the prehistoric people who occupied Glastonbury in the iron age.

The Athenæum of February 20 reported the discovery at Athens of an ostrakon, or potsherd, bearing the name of Themistokles. Of this curious find we are able, says The Builder—thanks to the Berliner Philologische Wochenschrift, February 27—to give our readers some further particulars. The ostrakon in question is a fragment of the brim of a large vessel, of black terra cotta ware. On its surface has been scratched with a sharp tool the words "Themistokles Phrearrios," in archaic letters. There can be no question that Themistokles is the famous statesman, and that one of the actual ostraka that condemned him to banishment in B. C. 470 has come to light. Up to the present time only three similar voting ostraka had been discovered, one on the Acropolis, with the name of Megakles, son of Hippokrates, the uncle of Perikles; another, also on the Acropolis, with the name of Xanthippos, the father of Perikles; and a third, bearing the same name but found in the Kerameikos. All three are published, and we hope the Themistokles ostrakon will shortly appear. It was found in the excavations being carried on by the German institute near the Areopagos.

Science Notes.

The Italian physicist Signor Pettinelli has been making a number of observations in the minimum temperature of visibility. He finds that the larger the hot surface, the lower the temperature required. With a surface equal to 23 square inches in area placed 2 feet from eye the minimum temperature necessary to render the surface visible in the dark is 400° C.

The death is announced of James Joseph Sylvester, the Savilian professor of geometry at Oxford; Professor Georges Ville, of the Paris Natural History Museum, who was professor of botanical physics and author of important works on fertilizers: also Professor Henry Drummond, the author of "Natural Law in the Spiritual World," "The Ascent of Man," and other works aiming at the reconciliation of theology with science and evolution.

The photography of ripples is a subject which seems to be of great interest, as is demonstrated by experiments by Mr. J. H. Vincent before the Royal Institution. Ripples produced on a mercury surface are invisible to the naked eye, but by means of an electric spark, photographs of ripples set up in mercury by a stylus attached to the tuning fork can be obtained. These photographs show in a novel way the phenomena of interference, diffraction, and spherical aberration.

There has been placed in the Treasury Whips' room at the House of Commons, London, for the inspection of members, a section of the barrel of a new Lee-Enfield rifle which has never been used, and a section of a similar weapon through which 4,650 rounds of cordite ammunition have been discharged. The latter is in a perfectly serviceable condition, and experts declare that it is good for another 8,000 rounds. As 300 rounds a year is the average number fired by a soldier, it follows that the life of a Lee-Enfield barrel is considerably over ten years, the official estimate of their period of utility.

The Sinking Fund Commissioners of the city of New York adopted a resolution, on March 25, setting aside 261 acres, the entire southern portion of Bronx Park, for the establishment of a zoological park, under the condition that the zoological society shall raise $100,000 before beginning to use the park and $150,000 within three years from the date that the work of improvement is begun by the park department. The society contributes the buildings and the collection of animals. The city of New York will spend $125,000 immediately in the preparation of the land and will during the first year of occupation provide a maintenance fund not exceeding $60,000 for the care of the animals and the further improvement of the park.

The international aerostatic ascents, which for some time past have been contemplated, took place on the 18th ult., at Paris, Berlin, and Strasburg. Three unmanned balloons were liberated at about 10 A. M.—local time—at each station. The Berlin balloon burst; the Strasburg balloon disappeared in the northeast, and has not yet been recovered; the Paris balloon descended, after having traveled during a little more than two hours in the N. N. ¼ E., and ran 102 kilometers, the temperature recorded being 60°, at an altitude of more than 10,000 meters. An apparatus, constructed by Cailletet, for bringing back to land a sample of the air of the upper atmosphere, was successful, but the gas captured has not, says Nature, yet been analyzed.

An ingenious application of Michelson's interference refractometer to the study of alternate currents and magnetic induction is described by Carl Barus in a recent number of the American Journal of Science. The slender iron cores of two identical coils are placed horizontally at right angles to each other and at the same distance from their point of convergence. The semi-transparent mirror is placed at that point, and a small mirror is mounted on the fore end of each core, the other ends being rigidly fixed. The distances are so adjusted that interference fringes are seen in the telescope. These disappear when one of the cores expands or contracts, but not when both do so to the same extent. Hence a delicate means is afforded of determining whether the oscillatory changes of length produced by an alternating current traversing both coils in succession have the same phase.

It is intended to establish at the Yerkes Observatory a museum for the preservation and exhibition of photographs, charts and drawings of the sun, moon, planets, comets, meteors, stars and nebulæ and their spectra, and of optical phenomena observed in the laboratory; photographs and drawings of astronomical and physical instruments; and portraits of astronomers, astrophysicists and physicists. Scientific men, learned societies and directors of laboratories and observatories are earnestly requested to assist in the formation of a library for the observatory by contributing to it copies of their publications. Photographs of scientific subjects, on glass or paper, will be very welcome for exhibition in the museum. Drawings and catalogues of scientific instruments are also desired. It is expected that the observatory will ultimately be able to make some return for such contributions in the form of its own publications and photographic results.

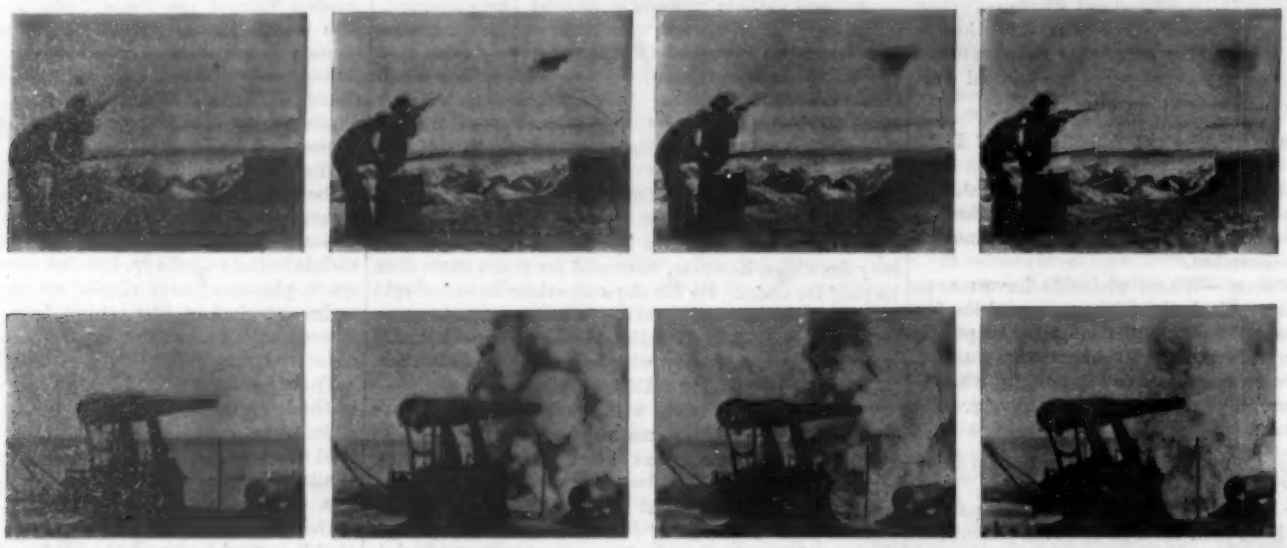
THE ART OF MOVING PHOTOGRAPHY.

The art of moving photography had its origin, or, to speak more strictly, its first suggestion, in that ingenious little toy known as the zoetrope, which enjoyed such great popularity some thirty or forty years ago. This, it will be remembered, consisted of a cardboard cylinder about a foot in diameter, which was rotated on a vertical axis and contained a series of vertical slots cut in its periphery. A strip of paper, on which were printed a series of moving figures, each one in a different position from its predecessor, was coiled around the inside of the cylinder just below the line of slots or peep holes, the distance between the figures being equal to the distance between the slots. As the cylinder was rotated, the figures appeared to be in motion. The illusion is explained by the fact that the eye is capable of receiving and recording only a given number of impressions in a given time, and if the successive pictures are presented to the eye too fast for their individual apprehension, they will blend, as it were, and produce on the mind the impression of a single picture.

The zoetrope had its day, and ultimately passed out of favor; but its very crude and imperfect moving pictures were full of suggestiveness. The optical laws by which the results were obtained in course of time attracted the attention of experimentalists in the then youthful art of photography. About ten years ago the French scientist Marey, while at work on a flying machine, obtained photographs of birds in motion by means of a number of cameras, whose shutters were operated by the wings of the birds as they flew across the room. The idea was then taken up and further developed by Dr. Muybridge, of Philadelphia. At an earlier day than this Mr. W. K. L. Dickson had been experimenting in the same field, and as the result of the subsequent joint labors of himself and Mr. Edison the famous Edison vitascope was produced. The Lumiere Brothers, a firm of French photographers, brought out the cinematograph in 1894, and this was succeeded shortly afterward by the biograph, which last device, and the "mutograph" and "mutoscope," are the inventions of Mr. Herman Casler and form the subject of the present article.

The machine, with which the original pictures are taken, is shown in Fig. 4. It is known as the "mutograph," nearly following the Latin and Greek words signifying "changing delineation." The camera frame is mounted by means of three adjustable legs upon a triangular turntable which may be placed upon any suitable support. Upon the top of the frame is bolted a two horse power electric motor, which is driven by a set of storage batteries, that will be noticed standing at the side of the machine. The combination of the turntable with the vertical adjustment before mentioned enables the camera to be shifted so as to take in the required field. In the front end of the camera is fixed a particularly perfect lens capable of gathering a great flood of light and producing an image of exceedingly clear detail. Above this lens on the front face of the camera is fixed a photographic "finder," which gives the same sized image as the main lens, and enables the operator to determine when the subject is properly focused. Inside the camera is a strip of gelatine film 2¾ inches wide and usually about 160 feet in length, which is wound upon a small pulley or drum. The length of the film varies for different subjects, and, in the case of a prolonged scene, it may extend to several thousands of feet.

The film is led through a series of rollers and caused to pass directly behind the main lens of the camera, and finally is wound upon a second drum. The object of the rollers is to cause the film to pass behind the lens with an intermittent instead of a continuous motion. At ordinary speeds this would seem to be a matter of simple accomplishment; but when we remember that impressions are taken at the rate of forty a second, and that the film, which is running at the rate of from 7 to 8 feet a second, has to be stopped and started with equal frequency, it can be understood that the problem was no easy one to solve. The film comes to a rest as the shutter opens, a phase or image is deposited, and the film starts again as the shutter closes. The impressions vary in actual exposure between one hundredth and one four-hundredth of a second. While the ordinary speed is forty a second, the mutoscope can take equally good pictures at the rate of one hundred per second if it is necessary. The higher speed would be used in photographing the flight of a projectile, or any object that was in extremely rapid motion.



"MUTOGRAPH" PICTURES OF CLAY PIGEON SHOOTING AND OF THE FIRING OF A TEN INCH DISAPPEARING GUN AT SANDY HOOK.

The mechanism within the cabinet is driven by belting from the motor above mentioned, and the speed of the motor is controlled with great nicety by means of a resistance box which is shown in our engraving, Fig. 4, mounted upon the storage batteries. The apparatus is here represented in the act of photographing the celebrated "Pennsylvania Limited" while it was running at the rate of about sixty miles an hour. The mutograph is set up at the side of the tracks upon a solid platform; the stretch of track is properly focused by the operator, and at the moment that the train comes into sight the current is turned on, the speed being regulated through the resistance box, as explained. By the time the last car of the train has flashed by, 160 feet of film has streamed past the lens, received its one thousand impressions and been wound with its precious record upon the receiving spool.

After the mutograph has done its work upon the films, they are carefully packed and sent to the New York establishment of the American Mutoscope Company. Here they are taken to the dark room, the interior of which is shown in the accompanying engrav

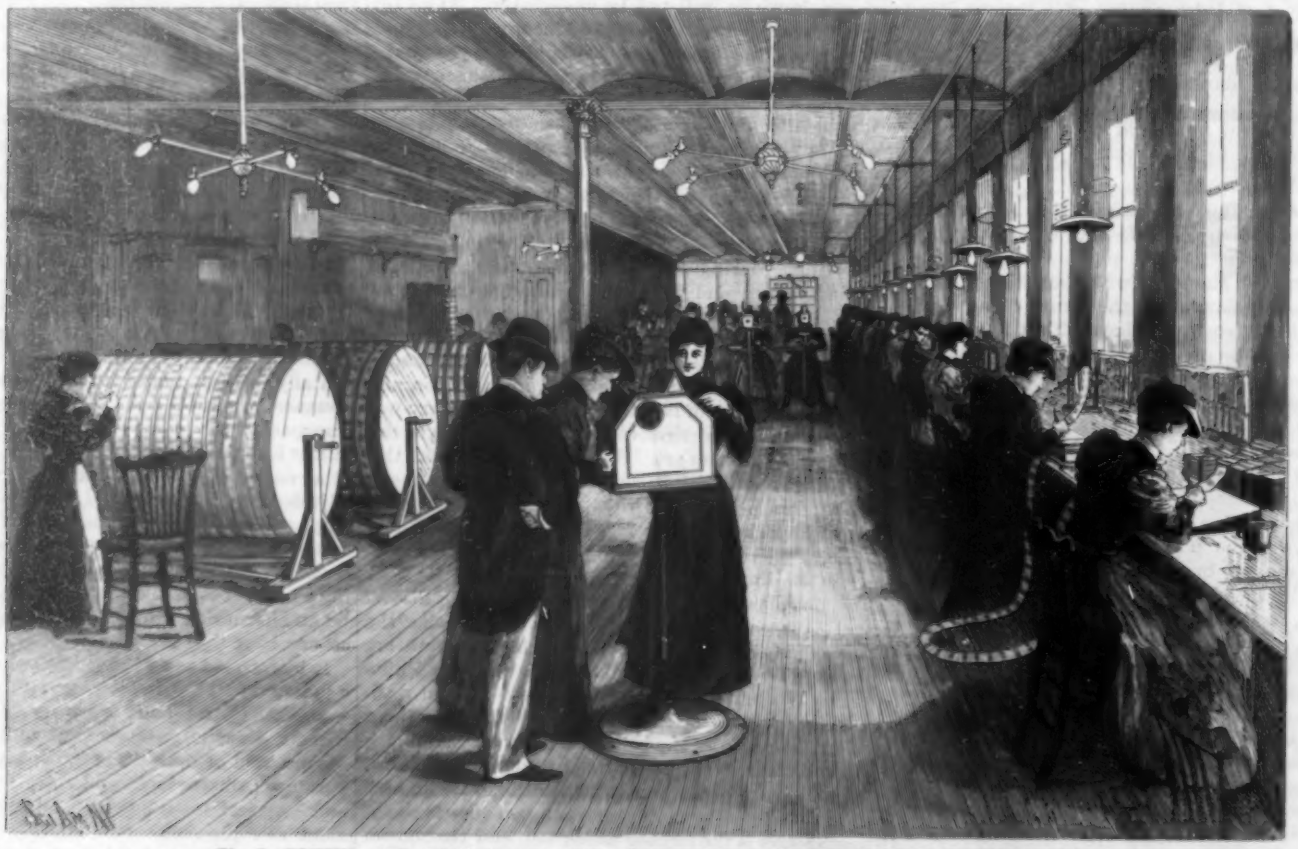


Fig. 5.—DRYING AND RETOUCHING ROOM "MUTOSCOPE" SHOWN IN THE FOREGROUND.

ing. Ranged along each side of this room is a series of troughs above which are suspended large skeleton reels, 3 feet in diameter by 7 feet in length, the axis of the reels being journaled in brackets attached to the ends of the troughs. The films are wound upon the reels and subjected to the action of the various solutions for developing, fixing, etc., with which the troughs are filled, the reels being transferred from bath to bath until the films are ready to go to the drying room. In this same department are prepared the positive transparent strips for use in the biograph, and the bromide prints for the mutoscope, as will be explained later in the present article.

The reels are then carried to the drying room, Fig. 5, where the films are unwound on to large wooden drums, of about the same size as the reels, where they are carefully dried. At the far end of the room are seen the machines for cutting up the bromide prints, and here also is carried on the work of retouching the films and prints and preparing them for use in the biograph and mutoscope machines.

The biograph (or life delineator), Fig. 2, is similar in its general appearance and construction to the mutograph. There is a similar arrangement of rollers and mechanism for controlling the movement of the film, and the machine is driven, as before, by an electric motor and controlled by a resistance box, which in the engraving is shown to the left of the operator. The chief difference observable in the interior of the biograph, as compared with the mutograph, is that the former contains a hand regulating arc lamp of 5,000 candle power, which is placed behind the lens. When a subject is to be thrown upon the screen, a spool containing the positive film is placed in the cabinet and run with an intermittent motion through the controlling rollers, down between the lamp and the lens, and finally wound upon a receiving spool. In order to insure that the best effect shall be secured it is necessary to run the film at the same speed at which it was taken—a result which is obtained by the use of a tachometer. The engraving shows the biograph at work in a New York theater. The whole apparatus and the operator are inclosed in a cabinet which is located at the back of the balcony. A hole is cut in the cabinet for the lens, and there is a window for the operator. The pictures are thrown upon a large screen upon the stage, and the subject which is represented in the engraving, an express train running at sixty miles an hour, is one of the most vivid representations of the kind ever attempted. The audience sees the clouds of steam, the whirring driving wheels, the splashing of the water in the track tank as the engine takes in its supply, the passengers waving handkerchiefs and the workmen swinging their hats as the train goes by; and then the vacant track, all of which is represented with a clearness of detail that is truly remarkable. The excellence of the results is due very largely to the relatively great size of the original negatives, which measure 2¼ by 2¾ inches, and are, therefore, very much larger than any thing that has ever been taken in this class of photography.

Perhaps the most novel of the three machines is the mutoscope, Fig. 3, which, on account of its compactness, simplicity of operation, and the large size of its pictures, is certain to win great popularity. In this machine the bulk, the complicated mechanism, and the motor of the biograph are replaced by a simple, box-like apparatus, no larger than the cover of a sewing machine. The enlarged pictures, 6 by 4 inches in height, are mounted in close consecutive order around a cylinder, and stand out like the leaves of a book, as shown in the illustration. In the operation of the mutoscope the spectator has the performance entirely under his own control by turning a crank which is placed conveniently to hand. He may make the operation as quick or as slow as fancy dictates, or he may maintain the normal speed at which the original performance took place, and if desired he can stop the machine at any particular picture and inspect it at leisure. Each picture is momentarily held in front of the lens by the action of a stop attached to the roof of the box, which allows the pictures to slip by in much the same way as the thumb is used upon the leaves of a book.

The capacity of the mutoscope is coequal with the camera. It reproduces in motion anything which can be photographed, whether motion of human bodies or movements in mechanism or nature. Thus the Falls of Niagara, conflagrations, moving trains, animals in action, athletic games and sports, scenes from plays introducing prominent actors in favorite roles; in fact, any scene can be reproduced with perfect fidelity to nature and with the actual movements presented by the scene depicted in a most realistic way. Important events in public or private life can be perpetuated, such as parades, military, civic, etc., preserving for the years to come the movements and gestures precisely as the scene occurred at the time of its recording by the camera, although some or all the participants in the scene may have long since departed.

Upon the roof of the New York establishment of the company there has been erected a large movable stage for taking photographs of celebrated scenes from plays or of individual performances in which it is desired

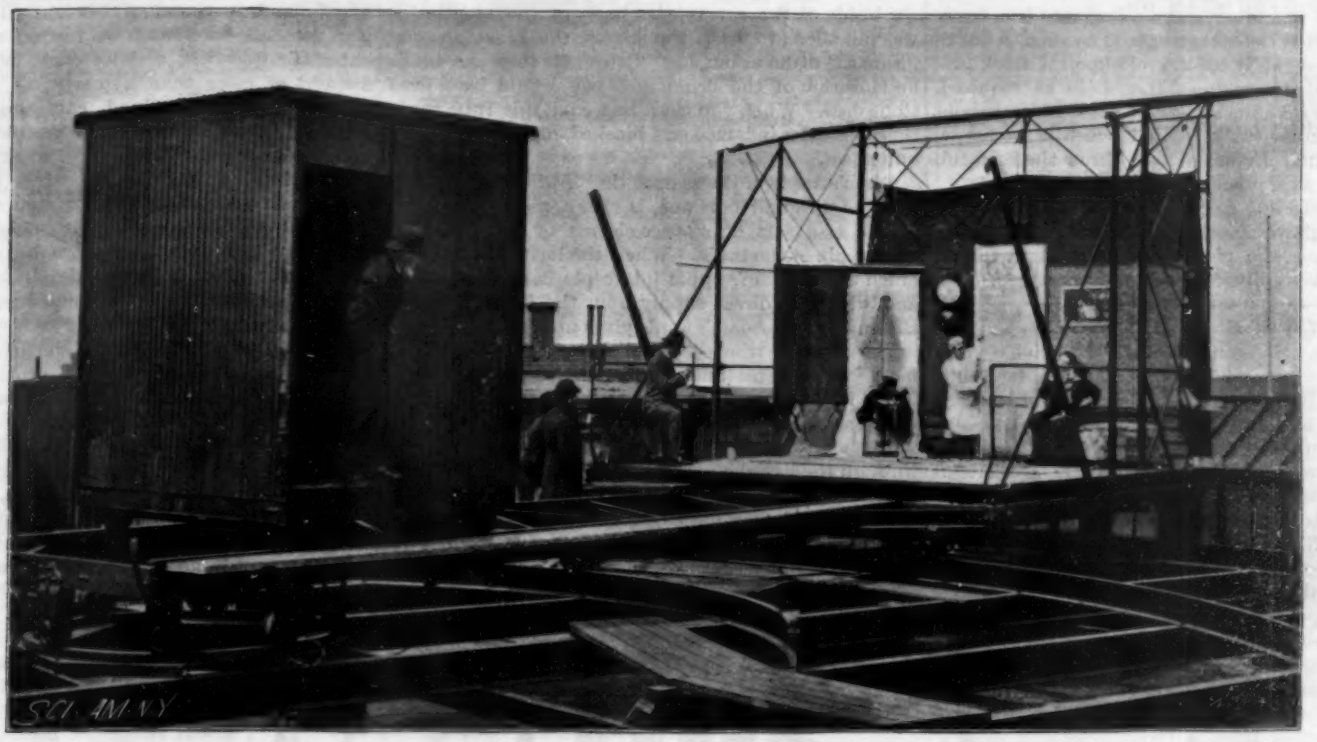


Fig. 6.—MOVABLE STAGE FOR PHOTOGRAPHING SCENES WITH THE "MUTOGRAPH."

ONE OF A SERIES OF "MUTOGRAPH" PICTURES, TAKEN AT THE RATE OF FORTY PER SECOND.

"MUTOGRAPH" PICTURES OF A BLANKET COURT MARTIAL AT GOVERNOR'S ISLAND.

to reproduce the motions as well as the features of the subject. The details of the structure can be clearly made out in engraving No. 6. It consists of a floor of steel I beams which carries a series of three concentric steel tracks. Upon this rotates a massive frame, at one end of which is a stage supplied with the necessary scenery, and at the other end a corrugated iron house in which is located the mutograph. The stage is bolted to the frame, but the house travels upon a track and may be moved to or from the stage as required. The frame carrying the stage and house rotates about the smaller circular track located beneath the house, and may be swung around so as to throw the light full upon the stage at any hour of the day.

Our thanks are due to Mr. Herman Casler, the inventor of the above described apparatus, and to Mr. W. K. L. Dickson, the pioneer investigator in the art of moving photography, for courtesies extended.

THE ESSICK HOT FLUID BATTERY.

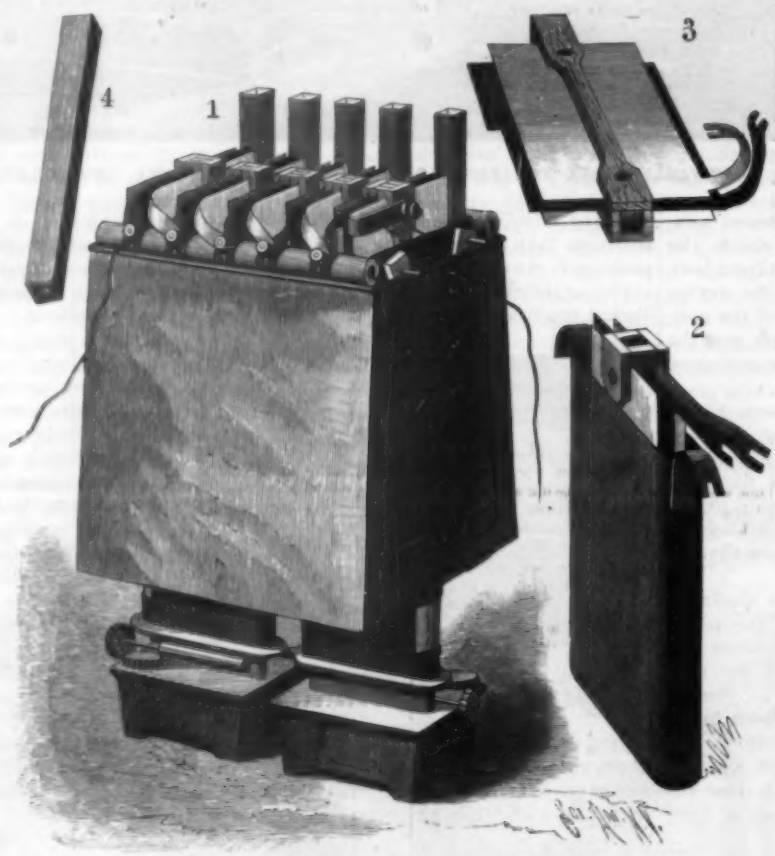
There has recently been exhibited in this city a new primary battery from which quite remarkable results are obtained. It represents a modification of the well known Daniell battery. It includes a zinc copper element of large superficial area excited by a solution of copper sulphate, its action being greatly accelerated by the application of heat.

The cell consists of a rectangular vessel, which, in the model battery illustrated, is 1⅝ inches by 8 inches in horizontal section and 11 inches high. Within the vessel are contained three plates, two of zinc and one of copper between them. Strips of wood are used to prevent contact of the plates. These are bolted together by bolts passing through the wood, as shown in one of the illustrations. For each cell a feeding tube, a rectangular tube of copper about an inch square, is provided, whose end is closed with a perforated diaphragm. This tube sets into one end of the cell. Through this tube, whose lower end is shown in the cut, copper sulphate solution is fed, or the tube may be packed with crystals of copper sulphate. It rests upon a projection of the copper plate, so that it reaches about half way down to the bottom of the cell.

Any number of these cells may be packed in the external vessel, which is bottomless, and merely holds them together and keeps the heat from disseminating. The supply of copper sulphate is introduced into the feeding tube, and heat is applied.

As a source of heat, a couple of ordinary kerosene oil stoves are used in the battery illustrated, which contains five cells connected in series. It will be evident from the description and drawings that the very large surface of copper and zinc are very close together. This, of course, tends to reduce resistance, besides which, both sides of the zinc are made fully operative, because the copper vessel is connected by the ribbon to the central copper plate, so that this interior surface acts as a negative element.

Quite extraordinary results are obtained. It is said that a single cell will give from fifteen to thirty-eight amperes at a pressure of about one volt. This, of course, makes the battery of very high power. How long it will run, in view of the fact that it has so small a cubic capacity for liquid and that no arrangements are made for keeping the liquid at a constant strength, is not certain.



THE ESSICK HOT FLUID BATTERY.

Queer Things About Mankind.

Few people are aware of the wonderful engineering skill and ingenuity with which their bodies are constructed. If patents were taken out for all the clever contrivances to be found there, they would probably keep the staff of the Patent Office going for three months.

Who would think that in his eye there is a block and pulley, or "tackle," as the sailors call it, as complete and efficient as that with which a ship hoists her mainsail? There it is, however; and whenever you look at the tip of your nose the muscle that moves your eyeball works in it. There are several of these pulleys in the body.

Another clever dodge of Nature is shown in the bones of the face. Accomplished engineer that she is, she always uses the smallest quantity of material sufficient for strength. In making the bones of the face, she wanted a large surface to which to attach the muscles; but, as she didn't wish to encumber us with heads as heavy as an elephant's, she burrowed hundreds of little holes in the bones, called air cells, and thus secured strength, large surface and lightness.

In the same way she made the long bones of the legs and arms hollow in the middle. What a saving this is may be understood from the fact that a hollow shaft of bone or iron—or any other substance—is about twice as strong as a solid shaft containing the same quantity of material.

When you get a severe cold you are apprised of the presence of another cunning device—the Eustachian tube. This tube is two inches long, and passes from the inside of the ear to the back of the mouth. It was put there to keep the air at the same pressure inside the drum as outside. Otherwise there would be no vibration of the drum, and you would be almost stone deaf. When you get a bad cold this tube sometimes becomes inflamed and blocked, and you are made quite deaf.

Adam's apple, if it was once that fruit that brought into the world all our woe, is now a useful organ. It serves as a sort of storage cistern of the blood for the supply of the brain. When the heart sends up too much blood Adam's apple intercepts it, or part of it; and when the direct supply from the heart temporarily runs short, Adam's apple gives up its store.

The liver is a most wonderful organ, containing facilities of several kinds. But perhaps the most wonderful thing in it is that part set aside to look out for and arrest poisons.

All the food that you eat, except the fat, has to pass through the liver before going to the heart and body generally; and in the liver there appear to be stationed something of the nature of customs officers, who examine every bit of food and remove from it all substances dangerous to the body. But they are only capable of dealing with the small quantities in ordinary food, and when you are so foolish as to eat poisonous mushrooms or mussels, they are quite overpowered.

Another protection from danger is afforded you by the supply of a small quantity of hydrochloric acid to the stomach. There are little machines in the stomach specially designed for the manufacture of this acid from the salt you eat, and they are so regulated that they produce a quantity equal to one-fifth of one per cent of the contents of the stomach. Experiment shows that this is exactly the percentage required to destroy the microbes that we swallow in thousands in our food. But for this thoughtful provision of Nature we would probably get a new disease with every meal.

Most people know the use of the epiglottis, which saves us from imminent death every time we swallow a bit of food. At the back of the mouth the air passage and the food passage cross each other, and, whenever we swallow food, it would inevitably go into the windpipe and choke us, only that this little body pops down and covers the entrance. It is like the policeman who regulates the traffic where streets cross.

The semicircular canals, for centuries a physiological puzzle, are an extraordinary device for enabling us to keep our balance. They are little channels, hollowed out, in connection with the ear, in the bones of the head, and partly filled with fluid lymph. As our head or body sways the fluid moves, acting like a spirit level, and informing the brain whether we are standing in the perpendicular or at a dangerous angle.

One of the most valuable of all the inventions made for our comfort and safety is the perspirative gland. It acts like the safety valve of a boiler, letting off heat when we are becoming dangerously warm. If our temperature rose seven or eight degrees, we would not have twenty-four hours to live. The value of the sweat gland is therefore obvious. In fact, without it a football, or cricket, or rowing match would be out of the question, and we could not safely walk at a speed of more than a quarter of a mile an hour. Nature has taken good care, however, that we should not run short of these useful organs, and has given us no less than 2,500,000 of them.

So inventive was Nature when constructing our body that the difficulty is to stop enumerating her clever ideas. She saw that we would very soon grow tired if we had to hold up two heavy legs by means of muscular effort, so she made the hip joint airtight, and the pressure of the air alone keeps the leg in its place.

At the same time, although she had not discovered ball bearings, she made the ball of the leg bone and the socket of the hip so smooth, and oiled the joint so well, that the friction is practically nothing.

When the spinal canal in the backbone was made, great pains had to be taken, for, while it consists of many pieces and is freely movable, it contains the precious spinal cord, one nip of which would be fatal. The measurements are so accurate that there is no danger of such an event. Wherever there is much and free motion, as in the neck, the canal is large and open, and a nip is impossible.

Again, the heart and lungs are, of course, the very basis of our life. They are in constant motion, and if allowed to rub against the chest walls around them they would either get inflamed or wear away by friction. Nature has therefore surrounded them with a double sac, and between the outer and inner layers of it she has placed a quantity of lubricating fluid.

But the most remarkable of all devices is that for splicing broken bones. The moment a bone is broken, a surgical genius is at once dispatched from the brain to the spot. He proceeds to surround the broken ends with a ferrule of cartilage. This is large and strong, and takes quite a month to complete. When the two ends are held firmly and immovably in place by the ferrule, this mysterious surgeon begins to place a layer of bone between them and solder them together.

And when the layer is complete and the bone securely welded he removes the ferrule, or callus, just as the scaffolding is removed from a finished building. Often a bone does not get broken for two or three generations, and yet this power to form the callus, and knowledge of how to do it, is never lost.—From Answers.

Horseless Cabs to Hire in New York.

In the SCIENTIFIC AMERICAN for March 13, 1897, will be found an article on the electric hansom cabs which were brought to New York to compete with ordinary cabs drawn by horses. It was quite a time before the company could obtain the necessary permission to run their cabs for hire upon the streets, but the licenses having been obtained, the cabs are now a well known sight in the upper part of New York, and occasionally they may be seen going as far down town as Wall Street, winding in among the trucks and cable cars. This open competition with horse-drawn vehicles may be regarded as one of the most satisfactory events in the motor carriage world for a long time.

A New Photographic Paper.

One of the latest novelties in the photographic line is a self-toning collodion sensitized paper prepared by coating the paper with a collodion emulsion mixed with the silver and the toning chemicals, such as chloride of gold. When a sheet of the paper is placed in the printing frame behind a negative, the printing takes place in the usual way, but instead of being a red color, it prints the same color as the ordinarily finished print does, the operation being continued until the print looks a trifle darker than is desired.

It is then placed directly in a fixing bath composed of hyposulphite of soda and water for a few minutes, washed in changing water for half an hour, then dried and mounted. The prints are very satisfactory, equaling in brilliancy those made in the ordinary way, and are said to be fully as permanent.

BY the consolidation of the two great iron manufacturing firms of Schneider and Canet, of Paris, the heads of the two foundries visited President Faure recently and assured him that France now has an iron manufacturing plant rivaling the Krupp establishment in Germany.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Nicholas J. Verret and Thomas H. Mooney, Pine Bluff, Ark. The engine invented by these inventors is designed to be very effective in operation, utilizing the steam to the fullest advantage while being of very simple and durable construction. It has an annular cylinder provided with slidable steam-cushioned abutments, an inlet and an exhaust port opposite the sides of the abutments, and a revolubie piston having cam heads extending into the cylinder and adapted to move the abutments outward. There are two heads on the piston, and while one valve delivers steam to act on one head, the steam is acting under expansion on the following head, insuring a continuous rotary movement with full pressure.

Mechanical.

VISE.—William J. Wanless, Bay City, Mich. This vise has, in conjunction with a swivel bottom, a swiveled front jaw, constructed especially to hold either straight or tapered work, and after the jaws have gripped the work both jaws can be revolved, if desired, in a complete circle, or held at any point in a circle that the character of the work may call for. A hollow cylinder passed loosely through the inner jaw of the vise carries the adjustable jaw, which may be moved to any desired angle to the clamping face of the inner jaw, and when the front jaw is loosened for swiveling it is self-adjusting to any conical form of work.

COMPOUND CUTTER AND PLIERS.—Lucien H. Tissot, Montecheroux, France. A tool more especially designed for the use of electricians is provided for by this invention, as it is adapted to cut heavy wires without injuring the cutting edges of the cutters. One jaw has a rigid handle and the other jaw is formed with an extension carrying a pivot on which is fulcrumed the other handle, the latter having a forward extension adapted to bear against the under side of a projection on the rear end of the first jaw. An auxiliary fulcrum is thus formed enabling the operator to cut very heavy wire without exerting high pressure on the handles, and without wabbling the pliers. Messrs. Alfred Field & Company, of No. 96 Chambers Street, New York City, are the agents for the sale of the improved tool.

AUTOMATIC FEEDER FOR CIGARETTE MACHINES.—John O. Eaton, Fall River, Mass. For cigarette machines in which a continuous filler is formed, this inventor has devised an automatic feeder, to cause an even and steady shower or stream of tobacco to be deposited in the feeding mechanism, in sufficient quantity for the filler, thus obviating the feeding by hand as heretofore. The carrier or feeder belt which carries the tobacco from the hopper to the chute leading to the feeding mechanism is provided with curved carding teeth, and means are arranged to prevent the carrier from taking too great an amount of tobacco.

BALING PRESS.—William A. Ross, Hico, Texas. This is a machine for baling cotton and similar fibrous materials cylindrically by winding, a core being dispensed with. An endless apron is arranged to run on three flanged drums or pulleys, one fixed in the frame of the machine and the other two journaled in heads that receive a rotary reciprocating motion, changing their position and slackening the apron to enlarge its loop as required by the growth of the bale. This movement is resisted by other mechanism whose action is automatically regulated to give a gradually increased compression to the bale as it increases in diameter.

Electrical.

TIME CHECK AND RECORDER.—Alexander Davidson, New York City, and Charles G. Armstrong, Chicago, Ill. This is a device designed mainly for use in connection with an electric ticket selling device of the same inventors, whereby reserved seats may be sold at different points without interference, but the invention is also applicable for noting the lack of synchronism in clocks, and other purposes. It comprises a set of annunciators, synchronized clocks, and commutators, with batteries and circuit wires to indicate automatically to a remote station the sale of any ticket at the selling station, also making a record showing the time of sale of every ticket.

AMALGAMATOR.—William Wright, New York City. The body of this amalgamator consists of a box frame supported in inclined position, having at its upper portion a bed of steel with concaved pocket and at its lower end a bed of copper with similar pocket, a copper surfaced cylinder revolving in the first pocket and a steel cylinder in the second pocket. The arrangement constitutes electrodes arranged in pairs, the current being passed through from one bed to the other through the cylinders, and the reversal of the current reversing the action of the machine to effect a release of the material from its receiving surfaces. The copper surface is coated with mercury, to retain any gold coming in contact therewith, and the only chemical necessary is a solution of common salt, which is fed in with the crushed material.

Agricultural.

SEED PLANTING MACHINE.—James C. McCormick, Findlay, Ga. This machine has a motor wheel which operates by chain and sprocket connection a toothed discharge wheel in the hopper, in connection with a grain discharge disk and brush, there being a slidable device connected with a hand lever for elevating the discharge wheel and closing a discharge valve. The machine has a plow or furrow opener, which may also be pushed down into the ground or raised by the adjustment of the lever, the raising of the plow enabling the planter to be readily moved from place to place.

CIDER PRESS.—Gerhard Baumann, Monmouth Junction, N. J. This is a press in which the whole apples may be supplied through a hopper and formed into pomace, which is carried forward between horisontally arranged extractors, consisting of endless traveling bands, between which the pomace is pressed to extract the juice. The apples are ground as they pass through the hopper, and the pomace is distributed by a spreader upon the carrier, the sheet of pomace being carried beneath a presser where the pressure may be regulated by weights on the levers of the presser rollers. The meshes of the carrier and a band around the presser are cleared of particles of pomace by brushes.

COW MILKING MACHINE.—Modestus J. Cushman, Waterloo, Iowa. This invention is for an improvement in pulsating milking machines, where the air vacuum in the teat cups is made to alternately increase and decrease from a maximum of twelve degrees to a minimum of four degrees of air pressure, it being desirable that the alternating pulsations shall be regular and decided. The invention comprises a combination with differentiated vacuum chambers, a milk receptacle, and air and milk pipes, and a valve mechanism applied to the pipes with means for operating the mechanism whereby the chambers may be alternately put in connection with and cut off from the milk pipe and receptacle.

Miscellaneous.

BICYCLE SADDLE.—William Boulton, Alpena, Mich. The frame of this saddle is formed of a single rod, preferably round in cross section, bent ordinarily to an oval or pear shape, and with downwardly curved coiled front portions, the seat proper being formed of a net-like covering woven around the front and sides of the frame and being such a distance above the coils as to hold the sides out of contact therewith. The straight ends of the rod below the coils form arms by which the saddle may be readily attached to the saddle post.

FLOORING.—William McPherson, Quincy, Cal. For the making of tesselated floors of ornamental blocks practically watertight and arranging and connecting the blocks to prevent warping, this inventor provides the blocks with grooves on all of their edges, the grooves being engaged by long and short tongue strips, while around the outside edge of the design are arranged L-shaped base strips, which also have grooves for the reception of tongue strips engaged by grooves in the blocks, the vertical portion of the base strips engaging with the wall of the room and being adapted to serve as a base board. With this construction the water used for cleaning cannot penetrate between the floor and wall.

ILLUMINATED SIGN.—Charles P. Gates, Brooklyn, N. Y. This is a sign which may be alternately illuminated and darkened, the shutters remaining a short time stationary both at the closed and open position, to heighten the attractiveness of the sign. A series of shutters is pivotally carried on the inside of the casing, a bar being pivotally connected to the shutters and to a pitman connected to a crank shaft, and the casing has orifices which the shutters close and open. A clockwork motor or an electric motor may be used to operate the device, which may be cheaply manufactured and readily set up in front of a store or in a store window.

INKSTAND.—Alexander J. Bluntach, Olivia, Minn. An attachment is provided by this invention whereby the cover of the ink well may be removed during the act of carrying the pen to the well, the cover being automatically replaced as the pen is withdrawn, thus keeping the ink free from dust, etc. A bail pivoted in the stand and rocking over the ink well is connected with the cover by lever arms on which bear springs, to normally hold the bail in position to place the cover on the ink well. As the hand holding the pen is brought down on a cross bar of the lever arms the springs are placed under tension and the cover is removed, to be replaced as the hand is withdrawn.

SIPHON.—James B. Smith and Adolphe L. Julienne, Jackson, Miss. This invention relates to siphons having valves in both legs to retain the liquid and obviate refilling the siphon for every operation. It consists of a frame with a tube guide or support, two tube clamps and compressors and a lever mechanism mounted on the frame and adapted to simultaneously operate the clamps or compressors, which simultaneously close the flow through both legs.

BRIDLE.—Richard W. Evans, Baird, Miss. This is a simple bridle, especially adapted for work harness, and which may be quickly adjusted to the desired size, and made mainly of cotton rope or material always at hand on a plantation. It is made with fittings formed of light castings, all of which may be readily slipped by the fingers to adjust the bridle as desired, no buckles, seams or rivets being required.

BARREL TAP.—Ignatz Wasserstrom, New York City. To facilitate the tapping of barrels containing liquids under high pressure, this inventor has devised a tap in which the pressure will have a tendency to force the valve tightly to its seat, thus preventing any possible leakage when the valve is closed. It comprises a bushing to be engaged in the bung hole, a tapered valve seat having opposite ports at the inner end of the bushing, a tapered valve having ports in its opposite sides, a perforated cap on the inner end of the bushing, and a key for turning the valve.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS ETC.

The Century Dictionary and Cyclopedia, published by the Century Company, of New York, was accepted as a very high authority, and became an acknowledged standard, on its first appearance. It was unique in that it combined an unabridged dictionary with a comprehensive but condensed cyclopedia. In order to extend the sale of this great work, the company is now putting in operation a plan which comprises the offering of prizes for the best answers to three examination papers containing fifty questions each. Sixty-six prizes in all are thus offered, two of them being for $500 each, and the questions are such as combine pleasure with mental exercise in a most attractive form, certain to be of benefit to all who engage in the competition.

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The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7146) C. H. B. writes: I have lately made a dynamo from directions in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, following the directions given there, except that I wound six windings on the fields instead of four (i. e., 12 layers of wire instead of 8), and instead of winding the armature with No. 20 wire, wound the first time around with No. 19 and the second time with No. 18 wire. The machine seems to light up 14 incandescent lamps of 52 volts and 16 candle power each in quite a satisfactory manner. Am I correct in supposing that so long as the same speed is kept up the machine will keep up its voltage, however many lamps may be connected on, and that it will therefore keep on lighting up more and more lamps until so much current will be flowing that the armature will be burned out? If my supposition is correct, how many lights such as I have described ought the machine to carry without danger to the armature? During one of my early trials with the machine, it suddenly commenced sparking, and on examination I found that the wooden sleeve inside the armature had shrunk, thus allowing the iron rings to slip on the sleeve and neighboring coils of wire to get short circuited at the commutator. A few of the windings, as I found on unwinding it, had burned out. I have thoroughly repaired the armature, made it so that the rings cannot slip, and rewound it with well insulated wire. Is there any way in which I can make a cut-out or circuit breaker of some kind which will absolutely protect the armature against burning out again? Is there any number of the SCIENTIFIC AMERICAN or SCIENTIFIC AMERICAN SUPPLEMENT which describes such a device? Will you please tell me the internal resistance and also the amount of current required by a 52 volt 16 candle power Edison lamp? A. If series wound, the E.M.F. at constant speed will tend to increase as more lamps are put on; if shunt wound, the reverse will be the case. There is danger of burning out the armature if too many lamps are run from it. Your armature will carry easily 3½ to 4 amperes—enough for 3 to 4 lamps. You can make or buy a four ampere fusible cut-out which will protect your armature. You have tried to make your machine give probably 14 amperes, or over three times its proper current, so it is no wonder that it burned out. The 52 volt 16 candle power lamp needs 1·38 amperes and has 37 ohms resistance.

(7147) J. N. W. asks: 1. What is the amount of current in volts and amperes that run the 641 motor with efficiency? A. It can take four or five amperes at seven or eight volts. 2. How many storage cells with five 6 inch by 5 inch plates would it take to run the above named motor with efficiency? A. The batteries are of rather small plate area. You might place them two in parallel and three in series, a total of six, for the motor. 3. I wish to make a few storage cells, with five 6 inch by 5 inch plates in each; how many positive and how many negative should I have, and what kind of paste should I fill the holes in the plates with? A. It is somewhat difficult to get good results with storage batteries. In our SUPPLEMENT, No. 845, we describe their manufacture; price 10 cents by mail.

(7148) S. W. B. writes: I have a lot of rubber garden hose that is cracking on the outside from exposure to the sun and rain. Can you tell me what to apply to stop it? Also tell me how to make a waterproof paint or coating for the inside of an iron tank to keep from rusting. A. Rubber Hose, etc., to Soften.—1. Dip in petroleum, expose to the air, and repeat the operation if necessary. 2. Ammonia, 2 parts; water, 4 parts. Expose for a few minutes. 3. If very hard, soften with vapor of carbon bisulphide, with the further application of vapor of kerosene. Coat your iron tank with asphaltum varnish to prevent it from rusting.

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ELECTRO-CHEMISTRY, RECENT ADvances in.—By J. W. Richards, A.C., Ph.D. A very exhaustive and interesting paper on the progress that has recently been made in the apparatus for and methods of prosecuting work in the domain of electro-chemistry. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1014 and 1015. Price 10 cents each. To be had at this office and from all newsdealers.

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Elevator, I. H. Venn 580,167
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DESIGNS.

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Prism light, O. H. Basquin	26,867
Prism light, W. S. MacHarg	26,868
Prism plate for windows, W. H. Winslow	26,864
Prism tile, O. H. Basquin	26,866
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